



AGRICULTURAL RESEARCH INSTITUTE  
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THE ANNALS  
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“ ..... per litora spargite muscum,  
Naiades, et circum vitreos considite fontes.  
Pollice virgineo teneros hinc carpite flores.  
Floribus et pictum, divæ, replete canistrum.  
At vos, o Nymphæ Craterides, ite sub undas  
Ite, recurvato variata corallia trunco  
Vellite muscosis e rupibus, et mihi conchas  
Ferte, Deus pelagi, et pingui conchyliis succo.”  
N. Parthenis Guannettus, Kol. 1.

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I. — *Barnacles of the Creusia-Pyrgoma Type from the Pleistocene of Barbados.* By THOMAS H. WITHERS, F.G.S.

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[Plate I. figs. 1-11.]

AMONG the Balanomorph barnacles inhabiting corals are two closely allied genera, *Creusia* and *Pyrgoma*. *Creusia* has a shell consisting of four compartments with well-developed radii, and the shell of *Pyrgoma* consists only of a single piece, the separate compartments having become fused together.

The Barbados specimens here described are interesting, because they represent the first fossil of this type found outside Europe. Moreover, they are from a definite West Indian locality, which was lacking in the case of the Recent specimens studied by Darwin, and with other specimens serve to throw a little more light on the evolution of this type of barnacle.

My thanks are due to Mr. F. W. Penny, F.G.S., formerly of Trinidad, for helping me to trace more precisely the locality of the Barbados specimens.

*Ann. & Mag. N. Hist.* Ser. 9. Vol. xvii.



*Creusia barbadensis*, sp. n. (Pl. I. figs. 3-11.)

? 1854. *Creusia spinulosa*, var. 4, Darwin, Ray Soc. Monogr. Cirripedia, Balanidae, p. 376, pl. xiv. figs. 6i-6l.

**Diagnosis.** Shell depressed, outwardly formed of a single piece in the smaller shells, but with two sutures at the carinal end in the older shells, and with four well-marked sutures on the inside of the sheath; orifice almost oval; basis sub-cylindrical, not permeated by pores. Scutum and tergum sub-triangular, fused together. Scutum slightly hollowed out near the basi-tergal angle, which is abruptly cut off. Tergum with the spur rather narrow and pointed; on the carinal side the basal margin is distinctly hollowed out, and on the inner carinal edge there is formed a broad flat plate.

**Horizon and Locality.** Pleistocene\* (disintegrated limestone), Brighton Estate, Parish of St. George, just over 6 miles E.N.E. of Bridgetown, on the main road from Bridgetown to St. Philip, Barbados. Altitude between 150' to 200'. The specimens bear the following label:—"From disintegrated limestone rock, Brighton Estate, St. Luke's Chapelry, Barbados. Rev. Greville I. Chester."

**Holotype.** A shell without basis, to which belongs the fused scutum and tergum (Pl. I. fig. 5), registered In. 22,541.

**Material.** Nine specimens in the Geological Department of the British Museum, namely, four complete shells with bases, In. 22,535-In. 22,538; three shells without bases, In. 22,539-In. 22,541 (one with four opercular valves, In. 22,540, and another, the holotype, with a fused right scutum and tergum, In. 22,541); two bases, In. 22,542-3.

**Description.** Externally, four examples (In. 22,537-8, In. 22,540-1), with a rostro-carinal length ranging from 5.8 to 6.9 mm. respectively, have the shell entire; but in the two larger specimens (In. 22,535-6), with a rostro-carinal length of 7.5 and 9.5 respectively, there is a suture formed on each side at the carinal end of the shell, but none at the rostral end, although there seems to be a whitish line indicating where a suture might be. On the inside of the sheath there are four definite sutures in all the specimens, but they are not nearly so well marked in the small examples. An attempt to break a medium-sized shell (In. 22,540) across the sutures seen on the inside of the sheath was only successful in that it broke diagonally

\* See A. J. Jukes-Browne and J. R. Harrison, 1891, "The Geology of Barbados," Quart. Journ. Geol. Soc. London, vol. xlvii. pp 225, 230.

across a rostral and a carinal suture, but the break was not clean. This shell showed some indication of the overlap of the rostrum over what would be the lateral compartment, if the compartments were separate. Another shell (In. 22,535) shows what might be regarded as the ala, but this is only to be seen on one side. There is no definite sutural edge, nor is there the slightest trace of septa, such as are seen in a typical *Creusia*.

Shell oval, with the rostral end more broadly rounded, depressed, and with rather prominent and closely approximating ribs radiating from the orifice, and continued on to the cylindrical basis. Orifice almost oval. On the inner side of the walls there are very distinct and rounded ribs which stand out very prominently, and between them a thin lamina is occasionally formed on the inside of the wall, thus forming small pores such as are seen at the carinal end of the shell figured (Pl. I. fig. 3). The lower edge of the sheath is usually free, but in one specimen the rostral end is closely attached to the inner wall. Basis unusually long, with thin walls, not permeated by pores.

Scutum sub-triangular, somewhat elongate transversely, with the basal margin convex, slightly hollowed out near the basi-tergal angle, which is rather abruptly cut off. The adductor ridge is very prominent, and, while its upper part extends high up and parallel to the articular ridge, the lower edge is broadly rounded, and extends right to but not below the basal margin. There is just the merest suggestion of a tooth near the rostral angle in one scutum (Pl. I. fig. 5).

Tergum about two-thirds the width of the scutum, with the furrow somewhat variable, for it is a little more open in one specimen (Pl. I. fig. 4) than in the other. In consequence of the closer folding in of the sides of the furrow, the latter specimen (Pl. I. fig. 5) has a narrower and more pointed spur, and on the surface the valve along the line of the adcarinal furrow forms a more prominent ridge. Spur about one-fourth the length of the valve. On the carinal side the basal margin is very distinctly hollowed out, and the basi-carinal angle is somewhat protuberant. Along the inner carinal edge a rather broad plate is formed, as is mentioned by Darwin in var. 4 of *Creusia spinulosa*, and the basal part of the plate forms the produced and rounded basi-carinal angle.

*Comparison with other Species.* The difficulty with these Barbados specimens is whether to refer them to the genus *Creusia* or to *Pyrgoma*. Darwin, of course, thought that

*Creusia* and *Pyrgoma* were too closely related to rank as distinct genera, but a typical *Creusia* can be distinguished by the presence of four separate compartments furnished with radii.

Their sub-cylindrical rather than cup-shaped basis, the absence of definite compartments with radii, and the apparent absence of definite sutural edges with septa, is more like the condition seen in *Pyrgoma*.

On the other hand, the opercular valves agree more closely with those of *Creusia*, especially with Darwin's var. 4 of *Creusia spinulosa*. They even agree with that variety in the presence of a plate on the inner carinal edge of the tergum (Darwin, 1854, pl. xiv. fig. 6 l), and it is difficult from the opercular valves not to regard them as belonging to that form.

Darwin's localities for his var. 4 are "Philippine Islands Archipelago" and "West Indies," but he does not state from which locality came the terga he figured (1854, pl. xiv. figs. 6 i-6 l). The specimens in the Zoological Department of the British Museum throw no light on this question. The shell of var. 4 has definite compartments with radii, and the sutural edges are marked with septa, which are distinctly branched in one specimen examined by me.

It may be that this Pleistocene form resembles *Creusia spinulosa*, var. 4, so closely in its opercular valves, because it is an offshoot from the same stock, and in the partial fusion of its compartments is in the early period of development towards the *Pyrgoma* stage.

In the circumstances, it seems best at present to give a distinctive name to this Barbados form, and in spite of the absence of definite radii to refer it to the genus *Creusia*. *Creusia spinulosa*, var. 4, is doubtfully included in the synonymy, and it is probable that further properly collected recent material may help to throw light on the difficulty involved.

*Pyrgoma* was considered by Darwin to be a further development of *Creusia*, through the complete coalescence of the four compartments. The geological distribution apparently throws no light on this, for forms have been described as *Creusia* and *Pyrgoma*, in each case having a range from Miocene to Recent. It is very probable, however, that a re-examination of the geologically earliest species described as *Pyrgoma* would result in showing that these forms are nearer to the *Creusia* type, with the compartments either separate or not completely fused; probably

only the Pliocene *P. anglicum*, among the fossil species, should rightly be referred to *Pyrgoma*.

The four fossil species referred to *Pyrgoma* are—*P. anglicum*, G. B. Sowerby\*; *P. costatum*, Seguenza\*; *P. diploconus*, Seguenza\*, and *P. rangi*, Des Moulins (which is considered by De Alessandri to be synonymous with *P. multicosatum*, Seguenza)\*; and these occur in the Tertiaries of Italy, France, and England.

Six species have been referred to *Creusia*, as a sub-genus of *Pyrgoma* (*C. sturi*, *C. fuchsi*, *C. costata* (Kramberger-Gorjanović), *C. moravica*, *C. miocenica*, and *C. darwiniana*), and all these have been described by V. J. Procházka† from the Miocene of Austria and neighbouring countries. Certain of these, especially *C. darwiniana*, have well-developed radii, and *C. sturi* has the sutural edges of the compartments septate and denticulated. De Alessandri‡ has suggested that of these species *Creusia fuchsi* is the same as *P. multicosatum*, Seguenza, and *Creusia moravica* the same as *Pyrgoma costatum*, Seguenza.

It has been possible to examine only one Miocene specimen, and this comes from the Upper Coralline Limestone (Upper Miocene) of Redum Majesa, Malta (Brit. Mus., In. 22,776), and is apparently identifiable with *Pyrgoma rangi*, Des Moulins (?= *P. multicosatum*, Seguenza). This specimen has no very definite radii, but there are indications of four sutures on the outer surface. On the inner surface there are four sutures on the inside of the sheath, and the alæ are weakly shown at the carinal end. The shell has a rostro-carinal length of 9 mm. It is significant that this is not a typical *Pyrgoma*, but is nearer to *Creusia*.

Of *Pyrgoma anglicum* several specimens from the Pliocene (Coralline Crag) of England have been examined. Externally they show not the slightest trace of any suture. One, a very fine example, has on the inside of the sheath two well-marked sutures at the carinal end (Pl. I. fig. 2), but there is no trace of any sutures at the rostral end. This shell has a rostro-carinal length of 6.5 mm. Four other specimens in the Geological Department of the British Museum, registered In. 15,949–In. 15,952, have two sutures on the sheath at the carinal end of the shell, but they are not so well marked, and they seem to be less distinct, or

\* 1855. Darwin, Palæont. Soc. Monogr. Foss. Balanidæ, p. 36; 1906. De Alessandri, Palæontogr. Ital. xii. pp. 320–322; 1922. De Alessandri, Act. Soc. Linn. Bordeaux, lxxiv. p. 228.

† 1893. Rozpravy, České Akad. Cis. Františka Josepha (II.), ii. pp. 1–53, pls. i. ii.

‡ 1910. Abh. k.-k. geol. Reichsanst. xxii. p. 126.

even non-existent, in the smaller shells. These specimens have a rostro-carinal length of from 3·3 to 5·5 mm. Darwin considered this Coralline Crag form to be identical with the recent species, although differing slightly among other characters in having more prominent ribs. These are well shown in the present specimen (Pl. I. fig. 1), and on the inner side of the shell, where part of the basis is still adhering, the pores of the basis are quite distinct (Pl. I. fig. 2), a feature often difficult to see.

The Pleistocene form (*Creusia barbadensis*, sp. n.) cannot be said to have radii, although there are indications of sutures on the outer surface. In the older specimens the two at the carinal end are quite definite, and even more definite on one side than the other, for it shows a shoulder or ala on which the radii, had they been developed, would overlap. It is at the carinal end of the sheath that the sutures are seen in the Pliocene, *P. anglicum*. Four well-marked sutures are present on the inside of the sheath (Pl. I. fig. 3) in all the specimens, but there is no definite trace of sutural edges to the compartments.

In the recent *Pyrgoma stokesi* two sutures at the carinal end of the sheath have been noticed by me in a specimen from the West Indies.

Darwin (1854, p. 355) has said of *Pyrgoma*: "The shell consists of a single piece, generally without any suture, even on the internal surface; and this is the case, at least in *P. anglicum*, in extremely young colourless specimens: nevertheless, in some specimens of this very species, and of *P. conjugatum*, there were traces of two, but only two, sutures on the sheath, one on each side towards its carinal end"; and (p. 357) "From the close alliance between this genus [*Pyrgoma*] and *Creusia*, it is probable that the shell, if examined immediately after the metamorphosis, would be found to show traces of four compartments." Darwin (1854, p. 361; 1855, p. 37) further said, presumably with regard to recent examples of *P. anglicum*: "In several specimens there were on each side, at the carinal end of the shell, a trace of a suture, which could be perceived on the sheath."

Granting that *Pyrgoma* is a development from *Creusia*, and I am convinced from the present evidence that this is the case, then the above fossil and recent species show in their varied development of sutures and radii on the outer surface, in the presence of two or more sutures on the inside of the sheath, and in the variability of development of the sutural edges, that the *Pyrgoma* stage is being reached independently along various lines.

II.—*A new Cirripede from the Niobrara Cretaceous of Kansas.* By THOMAS H. WITHERS, F.G.S.

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[Plate I. fig. 12.]

FOUR species of Cirripedia have so far been described from the Cretaceous of Kansas, namely:—

*Stramentum haworthi*\* (Williston), and *S. tabulatum*, Logan†; *Squama spissa*, Logan†, and *S. lata*, Logan†.

Judging from the description, and the particular plates that are said to be absent in the second species of each genus, it would appear that the second species is based on incomplete specimens of the first-named species.

*Stramentum haworthi* is represented in the Geological Department of the British Museum by several fine examples collected by Mr. Handel T. Martin, and some that added to our knowledge of the structure of that species and of the genus have already been described by me‡.

Quite recently efforts were made to obtain from Mr. Martin examples of the genus *Squama*, but, although many Cirripedes were sent, including some from the type-locality of *Stramentum tabulatum*, they all proved to belong to the species *S. haworthi*, even though some of the specimens did lack the carinal valves.

One of the blocks of chalk sent by Mr. Martin, however, exhibited a new species of Cirripede in close association with several examples of *Stramentum haworthi*, but, before proceeding to describe this new form, it might be appropriate here to say a word concerning the organism to which many of these Cirripedes are attached.

The described specimens of *Squama* are said to have been attached to specimens of *Inoceramus*, but, while the type of *Stramentum haworthi* is said to be attached to a shell of *Ostrea congesta*, most of the specimens are not attached to any obvious shell. In my paper (1920), it was stated that the specimens of *S. haworthi* had apparently been attached to some strap-like organism of which only a stain remains, and Mr. Martin, *in litt.*, has suggested that these impressions

\* Williston, 1896, Univ. Geol. Surv. Kansas, vol. ii. p. 243, pl. xxxvi.

† Logan, 1897, Kansas Univ. Quart. vol. vi. no. 4, Oct., ser. A, p. 188; 1898, Univ. Geol. Surv. Kansas, vol. iv. p. 498, pl. cxi.

‡ Withers, 1920, Ann. & Mag. Nat. Hist. ser. 9, vol. v. pp. 69 *et seq.*, pl. iv.

are flags or seaweeds. One small specimen among the present material, however, in no way differing from the other similarly slightly tapering impressions, which sometimes reach a foot long, has in places traces of suture-lines and, what is equally important, a fragment of a siphuncle. This individual specimen is an undoubted Baculite, although most of the shell has disappeared, and, while not actually proving that the other specimens are Baculites also, it certainly suggests such a probability. Most of the known examples of *Stramentum pulchellum* from the Cretaceous of England and Bohemia are attached to species of Ammonites.

Genus CALANTICA, Gray.

Subgenus TITANOLEPAS, Withers.

Valves of lower whorl large, high, but not incurved, and overlapping the bases of the valves of the upper whorl. Umbo of scutum subcentral, and of the remaining valves apical. Number of valves thirteen.

*Sub-genotype.* *T. tuberculata* (Darwin).

*Calantica (Titanolepas) martini*, sp. n.

(Pl. I. fig. 12.)

*Diagnosis.* Valves with fine transverse growth-ridges, crossed by fine, raised, closely-set, longitudinal ridges, not produced into blunt spines as in *T. tuberculata*. Scutum with the umbo situated more than one-third the extent of the valve from the apex, and the upper part of the occludent margin almost in line with the lower part. Tergum subrhomboidal, comparatively broad.

*Horizon and Locality.* Upper Senonian, Niobrara Series: 10 m. S.W. of Gove City, on Plum Creek, Gove Co., Kansas, U.S.A.

*Collection.* Collected by Mr. Handel T. Martin, and now in the Geological Department of the British Museum, registered In. 21,941.

*Description.* The available material consists of a single almost complete individual, of which most of the capitular valves are preserved, although slightly displaced, and the plates of the peduncle are much displaced.

The specimen has been squeezed from the direction of the lower carinal end, for the carina lies with the whole outer surface uppermost, and the adjacent tergum and scutum have been pushed slightly upwards and away from

the carina, exposing part of the opposing tergum. The subcarina lies towards the base of the carina and tergum, and the carinal latus has been pushed upwards and lies beneath the base of the tergum, but it is mostly covered by the median latus, which lies between the scutum and tergum. Both the rostral latus and the rostrum are absent, and the peduncle is represented by a jumbled mass of plates lying partly beneath an example of *Stramentum haworthi*. The inner surface of the opposing lower latera is partly shown, but not sufficiently so to enable one to make out the respective valves.

Carina moderately wide, tectum slightly convex transversely, not carinate; basal margin bluntly angular. Outer surface with from seven to eight widely spaced and raised growth-ridges, crossed by fine, closely-set, longitudinal ridges.

Scutum trapezoidal, moderately convex transversely, with the umbo prominent and situated little more than one-third the extent of the valve from the apex, and above the umbo the valve is produced into a somewhat acute angle; upper occludent margin almost in line with the lower margin; basal margin very slightly sinuous. The valve is bent to form a fold extending from the umbo to the basilateral angle, and a second fold extends from the umbo to the middle of the basal margin. Along the upper occludent margin the valve is slightly and narrowly raised to form a ridge followed by a shallow depression which is bounded by a further slight ridge. Outer surface marked by fine closely-set ridges radiating from the umbo.

Tergum subrhomboidal, comparatively broad, slightly convex transversely, with a feebly-marked curved apico-basal ridge or fold situated a little less than one-third the width of the valve from the carinal margin; upper part of valve slightly curled towards the scuta; carinal margin distinctly divided into two parts, which together form an obtuse angle; occludent margin, like that of the scutum, slightly raised to form a narrow rounded ridge, followed by a depression which is bounded by a further slight ridge. Outer surface marked by closely-set, raised, longitudinal ridges radiating from the apex.

Subcarina triangular, strongly convex transversely, subcarinate, with the basal margin somewhat concave and the lateral margins very slightly concave.

Median latus apparently forming almost an equilateral triangle, but a blow has crushed most of its outer surface, and, as that valve together with the tergum almost entirely



covers the carinal latus, the shape of the latter cannot be made out.

Peduncle-plates with the upper margin semicircular and the basal margin ranging from almost straight to deeply concave; the valves with the basal margin deeply concave are apparently from the lower part of the peduncle. Outer surface ornamented with five longitudinal ridges.

### *Systematic Position.*

This Cirripede is another Upper Cretaceous form which has independently developed in the scutum alone a subcentral umbo. It is this specialization of the scutum, correlated with a corresponding specialization of the carina and a reduction in the number of valves, that has given rise to such forms as *Orynaspis* and *Lepas*.

In the present Cirripede the scutum only has a subcentral umbo, and the valves of the upper whorl are singularly like those in *Zeugmatolepas* (*Z. mockleri*)\*. This emphasizes the difficulty of studying isolated valves, for in the absence of other evidence the present form might readily have been included in that genus. It is apparent, however, that our form has not several whorls of lower latera as in *Zeugmatolepas*, but, on the contrary, the close association of the peduncle-plates with the capitulum leaves little doubt that only a single whorl of lower latera was present. Certainly the median latus looks natural enough in its position between the scutum and tergum, but the fact that the carinal latus is in such close association with the valve, combined with the evidence that other valves are also pushed in the same direction, seems good evidence that it is out of position.

It, therefore, seems clear that this Cirripede had only a single whorl of lower latera, in which case it must be included in the subgenus *Titanolepas* of the genus *Calantica*. The subgenus *Titanolepas*† was founded to include the Cenomanian species *T. tuberculata* (Darwin), which differed from the typical Calantids in its specialized form of scutum. Evidence that *T. tuberculata*, or a closely related form, existed in the English Upper Senonian Chalk has recently come to my notice.

The valves of the upper whorl in this new Cirripede, as has been already stated, agree closely in shape with *Zeugmatolepas mockleri*, and the scutum especially is very

\* Withers, 1913, Proc. Zool. Soc. London, p. 938.

† Loc. cit. p. 943.

like some of the forms of that valve, but the valves of *Z. mockleri* are not closely and regularly ridged as in the present species—*T. martini*. In *T. tuberculata* the valves differ markedly in shape, and in addition they are more highly ornamented, for where the longitudinal ridges cross the transverse ridges they are produced into short blunt spines.

# EXPLANATION OF PLATE I.

*Pyrgoma anglicum*, G. B. Sowerby.

Pliocene, Gledgravian, Coralline Crag: Sudbourne, Suffolk.

Fig. 1. Shell. Outer view.  $\times 2$  diam.

Fig. 2. Inner view of same.  $\times 5$  diam.

*Creusia barbadensis*, sp. n.

Pleistocene, disintegrated limestone rock: 6 miles E.N.E. of Bridgetown, Barbados.

Fig. 3. Shell. Inner view. Brit. Mus., In. 22,539.  $\times 4$  diam.

Fig. 4. Scutum and tergum (fused). Outer view. Brit. Mus., In. 22,540.  $\times 5$  diam.

Fig. 5. Same, from holotype. Inner view. Brit. Mus., In. 22,541.  $\times 5$  diam.

Figs. 6, 8, 10. Three shells of different sizes (upper views). Brit. Mus., In. 22,535–37.  $\times 2$  diam.

Figs. 7, 9, 11. Side-views of same, showing subcylindrical bases.  $\times 4$  diam.

*Calantica (Titanolepas) martini*, sp. n.

Upper Cretaceous, Niobrara Series: 10 miles S.W. of Gove City, Gove Co., Kansas, U.S.A.

Fig. 12. Capitulum, almost complete, with the much displaced plates of the peduncle below. Brit. Mus., In. 21,941.  $\times 8$  diam.

## III.—*Æsophagostomes* from the Wart-hog.

By R. DAUBNEY, M.Sc., M.R.C.V.S.

IN recent publications five new species of the Nematode genus *Æsophagostomum* have been described from wart-hogs, three by Goodey (1924), one by Thornton (1924), and one by the writer (1924). The present note adds two more species to the list of members of this genus collected from wart-hogs. Both the new forms are closely related to *O. mwanzae*, Daubney, 1924. The material comprises two males and twelve females of *O. mwanzae*, two males and thirteen females of *O. roubaudi*, and a single female of *O. goodeyi*, all collected from a single wart-hog (*Phacochærus æthiopicus*). The locality

in which the specimens were obtained is French West Africa (Senoudebou, near Kayes, Upper Senegal). They were sent to Dr. H. A. Baylis, of the British Museum (Natural History), by Dr. E. Roubaud for determination.

*Cesophagostomum mwanzæ*, Daubney, 1924.

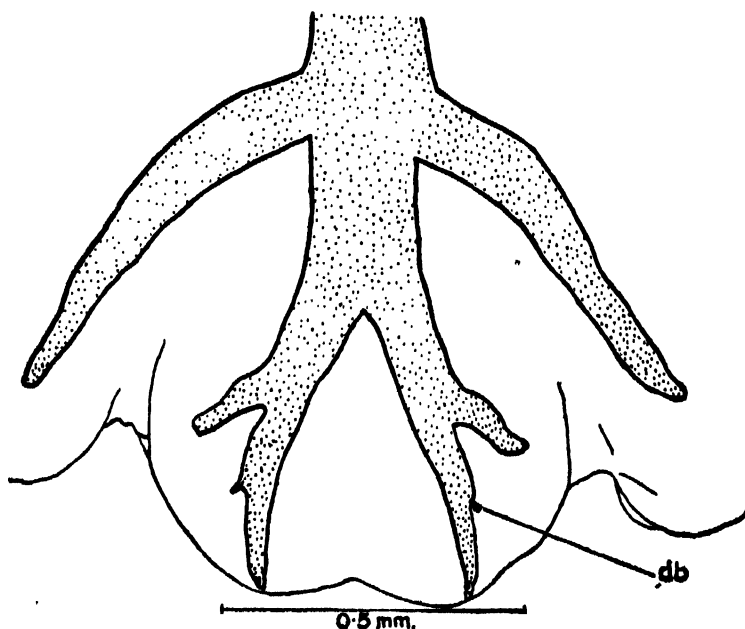
The interest attaching to these specimens of *O. mwanzæ* lies in their appreciably larger size and better development than the type-specimens or those described by Goodey and Thornton. As Goodey has rightly pointed out, the writer was in error in stating that an internal leaf-crown was present. There is no internal leaf-crown. There is nothing further to add to the existing descriptions of this species except to remark on the measurements of the new specimens, which are tabulated below. It will be evident that not only is there a difference in size between the new specimens and those measured in 1924, but that the new measurements might have served, in the absence of other characters, to distinguish *O. mwanzæ* from the two new species here described.

*Cesophagostomum roubaudi*, sp. n.

This species resembles *O. mwanzæ* so closely that it is unnecessary to give a detailed description or figures. It is sufficient to call attention to the few characters in which it differs and to refer to the table of measurements. Perhaps the most striking of these features is the absence of the cuticular flaps or valves at the base of the oesophageal funnel which are characteristic of *O. mwanzæ*. There is also a very marked difference in the length of the spicules, which measure 1.27 to 1.32 mm. in *O. roubaudi*, as against 2.0 to 2.15 mm. in *O. mwanzæ*. Goodey gives 2.0 to 2.9 mm. as the length of the spicules in *O. mwanzæ*. Possibly the second figure is a printer's error for 2.09, since, if it were correct, it would indicate an unusual degree of variation. The proximal or "handle" portion of the accessory piece is straight in the two males of this species. In the three males of *O. mwanzæ* examined by the writer the handle portion is flexed ventrally, although this was apparently not so in the specimens examined by Goodey and Thornton. It is also noticeable that the vagina is considerably shorter in the new species than in *O. mwanzæ*. For the rest, it will be seen from the table that the oesophagus is shorter and that the distances of

the cervical groove, the cervical papillæ, and the nerve-ring from the anterior end are all less than in *O. mwanzæ*.

Fig. 1.



Dorsal ray of bursa of *O. roubaudi*. *db.*, small branch of dorsal ray, present in both *O. roubaudi* and *O. mwanzæ*.

*Æsophagostomum goodeyi*, sp. n.

This species is represented by a single female. It is, again, extremely closely related to *O. mwanzæ*. In the absence of male specimens, the chief points of difference are the shortness of the œsophagus, the absence of valves, the situation of the vulva at the end of a tubular outgrowth, and the length of the vagina. The posterior end of the female is figured (fig. 2).

The three species here discussed resemble each other very closely. Goodey considers *O. mwanzæ* to be "most nearly akin to *O. simpsoni*—in the elliptical shape of the head, leaf-crown, etc., but not in the shape of the female tail and the

## Measurements in millimetres.

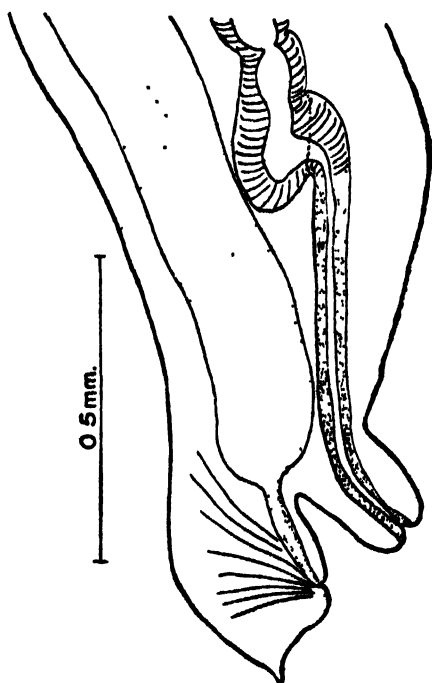
	<i>O. murze.</i>						<i>O. murze.</i>		<i>O. roubaudi.</i>		<i>O. goodeyi.</i>	
	Daubney, 1924.			Goodey, 1924.			Thornton, 1924.		Present collection.			
	♂.	♀.	♂.	♂.	♀.		♂.	♀.	♂.	♀.	♂.	♀.
Total length . . . . .	13	15-20	13-16	16-20			11-12	14.7-18	16-19	23-24	16-17	21-22.5
Maximum thickness . . . . .	0.48	0.72	0.3-0.5	0.4-0.6			0.43-0.47	..	0.56	0.9	0.54	0.78
Cervical groove and excretory pore from anterior end.		0.16	..	Over 0.2			..	0.28-0.29	0.43	0.50-0.52	0.31	0.36-0.38
Cervical papillae from anterior end.	0.32	0.36-0.4	..	0.35			..	..	0.47	0.55-0.6	0.4	0.42-0.44
No. of elements in external leaf-crown.		6	..	6			..	6	..	6	..	6
Buccal capsule, depth . . .		0.054	..	..			..	..	..	0.047-0.055	..	0.045
Buccal capsule, dorso-ventral diameter.	..	0.126	..	Almost 0.1			..	0.1	..	0.09-0.1	..	0.1

Esophagus, length .....	0.7	0.7-0.8	..	0.8-0.9	..	..	0.84-0.86	1-1.16	0.75	0.725-0.8	..	0.62
Esophagus, maximum thickness.	..	0.14-0.22	..	0.18	..	..	0.21	0.29	0.19	0.22	..	0.16
Nerve-ring from anterior end	..	0.35	..	0.35	..	..	0.47	0.59	0.4	0.42	..	0.46
Length of tail .....	..	0.08	..	Little more than 0.1	..	0.125-0.176	..	0.2-0.22	..	0.16-0.176	..	0.15
Vulva from posterior end ..	..	0.12-0.21	..	0.3	..	0.3-0.36	..	0.29-0.31	..	0.44-0.52	..	0.3, process .175 long.
Vagina, length .....	..	0.48	..	0.48-0.58	..	..	..	0.35-0.50	..	0.17-0.26	..	0.63
Eggs .....	..	0.065-0.086-43	..	..	..	0.064-0.071	..	0.064-0.072	..	0.064-0.074	..	0.066 x 0.044
Spicules, length .....	2.075	2.0-2.9*	..	..	..	0.034-0.037	..	0.035-0.045	..	0.036-0.044	..	..
Accessory piece, length ....	0.13	0.16	..	..	0.1-0.12	..	0.125-0.13	..	0.145	..	..	..

\* Possibly an error.

oesophagus." The writer, in 1924, pointed out that *O. mwanzae* had certain features in common with *O. brumpti* and *O. apiostomum*. At the time these suggestions were made, *O. simpsoni* had not been described and no good description of *O. dentatum* was available. Undoubtedly Goodey's excellent description of *O. dentatum* shows that *O. mwanzae* is more nearly related to this species than to either *O. brumpti* or *O. apiostomum*.

Fig. 2.

Caudal end of female of *O. goodeyi*, lateral.

While agreeing completely with Goodey and Thornton that the genus *Æsophagostomum* seems to be in no need of division into subgenera, it appears to the writer that *O. oldi*, Goodey, 1924, has quite as many features in common with *O. mwanzae* as has *O. simpsoni*. It may, perhaps, be of assistance in determining specimens to note that the forms (occurring in the wart-hog) in which the number of elements in the external leaf-crown is six are *O. oldi*, *O. mwanzae*,

*O. roubaudi*, and *O. goodeyi*. In *O. oldi* the buccal capsule is circular, in the other species elliptical.

#### REFERENCES TO LITERATURE.

- DAUBNEY, R. 1924. "Description of a new Nematode, *Æsophagostomum mwanzae*, from the Wart-hog." *Ann. & Mag. Nat. Hist.* (9) xiii. pp. 542-546.
- GOODEY, T. 1924. "The Anatomy of *Æsophagostomum dentatum* (Rud.), a Nematode Parasite of the Pig, with Observations on the Structure and Biology of the Free-living Larvæ." *Journ. Helminthology*, London, ii. pp. 1-14.
- . 1924. "Some new Members of the Genus *Æsophagostomum* from the Roan Antelope and the Wart-hog." *Ibid.* ii. pp. 135-148.
- THORNTON, H. 1924. "A Review of the *Æsophagostomes* in the Collection of the Liverpool School of Tropical Medicine." *Ann. Trop. Med. Parasit.* Liverpool, xviii. pp. 393-408.

#### IV.—On some new and little-known Delphacidae from South Africa (*Fulgoroidea*, *Homoptera*). By F. MUIR, Hawaiian Sugar Planters' Experiment Station, Honolulu, T.H.

THE material dealt with in this paper consists of two small collections, one received from the British Museum through Mr. W. E. China and the other from the Imperial Bureau of Entomology through the Director, Dr. Guy A. K. Marshall. Twenty-six species have been recognized, seventeen of which have been treated as not hitherto named. When we consider what a very little work has been done in this family in Africa, this is not an exceptionally high percentage of new species.

#### TROPIDOCEPHALINI.

##### TROPIDOCEPHALA, Stål.

##### *Tropidocephala flaviceps*, Stål. (Figs. 1, 2.)

One male specimen from Weenen, Natal (*H. P. Thomasset*, December 1923), which the writer identifies as this species. The type-material of this species consists of a single female. The genitalia are very distinctive. This species has the apex of face truncate and the lateral carinæ do not continue so as to divide the frons from the clypeus. It may be advisable to retain *Nephropsia*, Costa, at least as a subgenus, for those species in which the apex of face is rounded and the lateral carinæ continue across.



*Tropidocephala incompta*, sp. n. (Figs. 3, 4.)

**Male.**—Length 1·7 mm. ; tegmen 1·8 mm. ; wing 1·4 mm.

Vertex as long as pronotum, width at base 1·5 times the length. The lateral carinæ of frons not continued at apex, and meeting but continuing on to clypeus. The pygofer is cut back on latero-dorsal margin with the ventral and ventro-lateral margins projecting, a small quadrate projection on

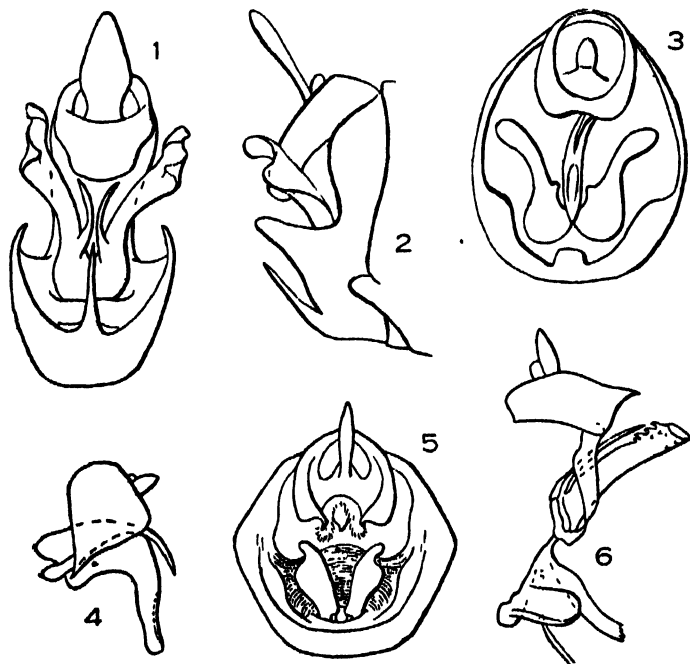


Fig. 1.—*Tropidocephala flaviceps*, Stål, full view of ♂ genitalia.  
 Fig. 2.—Ditto, lateral view of ♂ genitalia.  
 Fig. 3.—*Tropidocephala incompta*, Muir, full view of ♂ genitalia.  
 Fig. 4.—Ditto, lateral view of anal segment and aedeagus.  
 Fig. 5.—*Columbiana turneri*, Muir, full view of ♂ genitalia.  
 Fig. 6.—Ditto, lateral view of aedeagus and anal segment.

medio-ventral margin. The aedeagus has the spine from its base so characteristic of many of this genus.

Brown, darker over abdomen, vertex, and nota; a dark mark on basal segment of antennæ and two along the second segment; the carinæ of frons, vertex, and thorax white or light. Tegmina uniformly light brown with similarly coloured veins; wings hyaline with light brown veins.

Female a little larger in size and darker in colour.

Described from nine males and one female from Hill Station, Sierra Leone (*E. Hargreaves*, 6th December, 1924).

These specimens can be considered as brachypterous, as the wings are not normal or functional.

#### COLUMBIANA, Muir.

The genera *Eurysa*, *Liburniella*, *Columbiana*, and *Columbisoga* run close together, and will require a careful revision before very long, as species from South Africa and South America are more studied.

#### *Columbiana turneri*, sp. n. (Figs, 5, 6.)

*Male*.—Macopterous; length 2.3 mm.; tegmen 3.8 mm.

Length of vertex about equal to width at base, the base straight, apex slightly curved, the inverted V-shaped carina distinct, the Y-carina with stalk missing. Length of frons twice the width, sides slightly arcuate, widest about middle, median carina simple, distinct; the transverse carina between frons and vertex obscure; clypeus tricarinate. Antennæ reaching nearly to middle of clypeus, first segment longer than wide, second about twice the length of first. Lateral pronotal carinæ but slightly curved, diverging posteriorly, not reaching hind margin.

Pygofer with opening broader than long, sides entire, rounded; anal emargination shallow, anal angles obscure; diaphragm produced into a thin broad plate, bilobed at apex, the sides standing out on sides above the margins. Anal segment with two small curved spines on ventral margin, a small membrane basad of spines. Aedeagus sub-tubular with a long, nearly straight spine arising from the base or from the perianthrium, four small teeth on dorsal aspect at apex.

Stramineous; dark fuscous on hind margins of abdominal tergites; tegmina hyaline, clear, veins basad of cross-veins light, distad of cross-veins brown. Wings clear hyaline, veins brown.

Described from one male from Umtata, Transkei (*R. E. Turner*, February 1923).

There are four females from Port St. John, Pondoland (*R. E. Turner*, April 1923), which belong to this genus, but the writer refrains from describing from females only.

## EURYSA, Fieber.

*Euryrsa furcifera*, sp. n. (Figs. 7, 8.)

*Male*.—Length 2.1 mm.; tegmen 2.4 mm.

Head as wide as thorax. Width of vertex slightly greater than length, apex equal to base, sides slightly concave, base considerably before the middle of eye. Length of frons 1.6 times the width, sides slightly arcuate, broadest near middle; carinae at apex of vertex and base of frons obscure. Antennae reaching slightly beyond base of clypeus, first segment slightly longer than broad, second about twice the length of first. Lateral pronotal carinae slightly curved, diverging posteriorly, not reaching hind margin. Mesonotum tricarinate, carinae not very distinct. Hind basitarsus as long as the other two together, spur not as long as basitarsus, thin, tectiform, the outer half thinner than the inner, no spines on hind margin.

Frons, antennae, clypeus, legs, lateral portions of pronotum, and tegulae light brown; vertex darker brown; median portion of pronotum and all the mesonotum dark shiny brown; abdomen dark brown, lighter on basal tergites and on pleura. Tegmina hyaline, clear, slightly fuscous over apical portion of *C*, *Sc*, and first *M* apical cells, veins yellowish, apical veins and apical margin slightly fuscous, granules small, bearing dark macrotrichia. Wings clear hyaline with yellowish veins.

Anal emargination of pygofer not deep, anal angles rounded, not produced, lateral margins entire, rounded, ventral margin emarginate. Anal segment short, the ventral margin produced into two strong long spines, their bases contiguous but divergently curved to the apices; basad of these spines there arises two membranous appendages. The aedeagus is nearly straight, slightly flattened laterally, the apical portion flattened more than rest and dorsally produced into a rounded flange, opening along ventral aspect at apex, a few small spines along the margins. Genital styles forked, the outer fork large, sinuate, gradually decreasing to acute apex, inner fork small, thin, straight, with the apex curved.

*Female*.—2.3 mm.; tegmen 2.6 mm.

Similar in build and colour to the male.

Described from two males and one female from Aliwal North, Cape Province (*R. E. Turner*, December 1922).

*Euryrsa pullata*, sp. n. (Figs. 9, 10.)

*Male*.—Brachypterous; length 2.3 mm.; tegmen 1 mm. In build and colour this species is very similar to *E. atrata*,

but differs in having the vertex proportionately wider (1 to 1.4 mm.) and the carinæ of frons and vertex much more obscure. The genitalia are very distinct and come nearer to *E. furcifer*. In profile the lateral margins of the pygofer are straighter and not so produced, the genital styles are furcate. The outer prong thick, curved and recurved at apex, the inner prong short and thick. The ædeagus is slightly compressed laterally, in lateral view the basal half

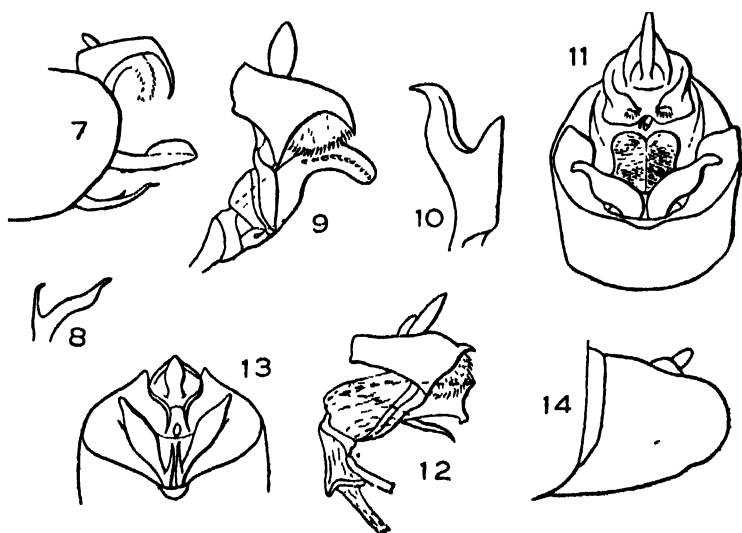


Fig. 7.—*Eurysea furcifer*, Muir, lateral view of ♂ genitalia.

Fig. 8.—Ditto, right genital style.

Fig. 9.—*Eurysea pullata*, Muir, lateral view of anal segment and ædeagus.

Fig. 10.—Ditto, left genital style.

Fig. 11.—*Eurysea nigrocacumenia*, Muir, full view of ♂ genitalia.

Fig. 12.—Ditto, lateral view of anal segment and ædeagus.

Fig. 13.—*Eurysea atrata*, Muir, full view of ♂ genitalia.

Fig. 14.—Ditto, lateral view of pygofer.

deepest, the apical half more tubular, slightly curved ventrad, with a row of teeth from apex to middle on each side. The anal segment is short with two stout curved spines on ventral surface with their bases rather far apart. Behind or basad of each spine there is a membranous appendage.

Described from three males from Mossel Bay, Cape Province (R. E. Turner, February 1922).

*Eurysa atrata*, sp. n. (Figs. 13, 14.)

*Male*.—Brachypterous; length 2·7 mm; tegmen 1 mm.

Head as broad as thorax. Vertex slightly wider than long, apex rounded, base straight, about middle of eyes; length of frons slightly greater than width (1 to 1·2), sides slightly arcuate, the carinæ over apex of vertex and base of frons and the median frontal carina obscure. Antennæ reaching slightly beyond base of clypeus, first segment a little longer than wide, second considerably longer than first. Lateral pronotal carinæ straight, diverging posteriorly, not reaching hind margin. Tegmina reaching to fourth abdominal segment, apex broadly rounded. Hind basitarsus slightly longer than the other two together; spur not so long as basitarsus, thin, tectiform, without teeth on outer margin.

Pygofer and abdomen considerably flattened horizontally, opening wider than long; anal emargination deep and continued as a depression to the base of pygofer, anal angles distinct, angular, not produced, sides rounded, entire, medio-ventral margin emarginate in middle, in lateral view sides rounded and produced. Anal segment slightly compressed laterally, two large curved spines on ventral surface, their bases fairly close together, divergingly curved. Genital styles lanceolate, with a spine arising from near base on inner margin. *Ædeagus* not dissected.

Black; antennæ, apex of clypeus, labium, legs, and anal style yellow.

Described from two males from Mossel Bay (*R. E. Turner*, February 1922).

*Eurysa nigrocacuminis*, sp. n. (Figs. 11, 12.)

*Male*.—Brachypterous; length 2·3 mm.; tegmen 2·1 mm.

Head as broad as thorax; width of vertex 1·3 times the length; medio-frontal carina distinct except at base. Tegmina reaching beyond the apex of abdomen, wings absent. Tibial spur normal for the genus.

Brown; carinæ of frons and genæ lighter; tarsi black or dark fuscous-brown. Tegmina hyaline, clear, apical cells fuscous, veins same colour as membrane, granules minute, sparse, bearing small dark macrotrichia.

Genitalia figured; there is a membranous appendage basad of each of the small anal spines. The *ædeagus* is flattened laterally, nearly straight, apex truncate with the dorsal and ventral corner produced into a small curved spine; from the base on the left side arises a spine nearly as long

as the ædeagus, flat laterally, broad at base, and gradually tapering to an acute apex.

Described from one male from Umtata, Transkei (R. E. Turner, February 1923).

# DELPHACINI.

## AMBLYCOTIS, Stål.

In *Amblycotis* the frons is about as wide as long, whereas in *Pseudaraëopus*, Kirk. (= *Delphacodes*, Melichar, not Fieber = *Geonocossus*, Muir), it is distinctly longer than wide; most likely further discoveries will connect them.

### *Amblycotis laticeps*, Stål. (Fig. 15.)

Four males from Port St. John, Pondoland (R. E. Turner, April, May 1923). So far as the writer knows, this is the only record apart from the type-material\*.

The pygofer is cut back on the ventral and lateral margins, so that, instead of there being the normal anal emargination, there is an anal projection over the anal segment; from the medio-ventral area there arises two long slender spines, parallel and near together. The species of *Pseudaraëopus* have a similar type of pygofer.

## PERKINSIELLA, Kirkaldy.

### *Perkinsiella saccharicida*, Kirk.

One male specimen from Mauritius (J. E. M. Brown).

## EMBOLOPHORA, Stål.

### *Embolophora monoceros* (Stål). (Fig. 16.)

Three males and two females from Weenen, Natal, 2840 feet elevation (H. P. Thomasset, December 1923; March, April, May 1924). This was described from two female specimens now in the Stockholm Museum, and has not been taken since, so far as the writer knows†.

## RHINOTETTIX, Stål.

### *Rhinotettix fuscipennis*, Stål. (Figs. 17, 18.)

This was described from a single specimen without an abdomen, which is now in the Stockholm Museum.

\* Walker lists this as being in the British Museum Collection (List Hom., Suppl. p. 326), but the writer has not seen a specimen in that collection.

† Walker lists this as being in the British Museum Collection (List Hom., Suppl. p. 323), but the writer has not seen a specimen in that collection.

The present specimen, the second in collection, so far as the writer knows \*, is a female without tegmina or wings, and was collected by Charles Darwin at the Cape of Good Hope. The spur is thin, tectiform, with twelve distinct teeth on hind margin, and so it comes into the Delphacini. Basal segment of antennæ longer than wide, second segment considerably longer than first.

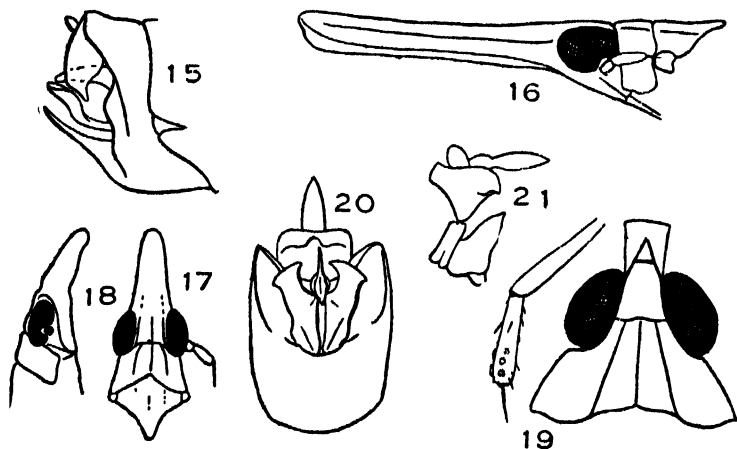


Fig. 15.—*Amblycotis laticeps*, Stål, lateral view of ♂ genitalia.

Fig. 16.—*Embolophora monoceros*, Stål, lateral view of head, pronotum, and mesonotum.

Fig. 17.—*Rhinotettix fuscipennis*, Stål, dorsal view of head and thorax.

Fig. 18.—Ditto, lateral view of head and pronotum.

Fig. 19.—*Nataliana lineata*, Muir, dorsal view of head and pronotum and antenna.

Fig. 20.—Ditto, full view of ♂ genitalia.

Fig. 21.—Ditto, lateral view of anal segment and aedeagus.

#### NATALIANA, gen. nov.

Length of vertex nearly double the width, lateral margins nearly straight or slightly concave, subparallel, apex considerably beyond eyes, slightly rounded, base well behind middle of eyes, slightly sinuous; an A-shape arrangement of the carinæ not reaching to apex of vertex. Frons long, narrow, length three times the width, sides slightly sinuate,

\* Walker lists this as being in the British Museum Collection (List Hom., Suppl. p. 326), but the writer has not seen a specimen in that collection. [There is in the B.M. Collection a ♂ from Springbok, Little Namaqualand, S.W. Africa, October 1890, and a ♀ from Barbarton, Transvaal.—W. E. CHINA.]

slightly wider at apex than at base, median carina distinct, simple. Clypeus distinctly tricarinate, long, narrow. The junction of vertex and frons rounded in lateral view, and the frons and clypeus nearly straight. Pronotum tricarinate, lateral carinae straight, slightly diverging posteriorly, reaching hind margin. Mesonotum distinctly tricarinate. Antennae terete, nearly as long as frons and clypeus together, first segment slightly longer than second. Hind basitarsus longer than other two together, spur not so long as basitarsus, wide, thin, concave on inner surface, convex on outer surface, about 22 to 25 small teeth on hind margin. Legs long and slender. The nature of the spur places this genus in the Delphacini. Type, *lineata*.

*Nataliana lineata*, sp. n. (Figs. 19, 20, 21.)

*Male*.—Brachypterous; length 4 mm.; tegmen 5 mm.

Tegmina long and narrow, broadest near base at angle of clavus, then gradually narrowing to apex which is narrowly rounded; wings considerably shorter than the tegmina, but of similar shape. Genitalia figured, the aedeagus is small and of peculiar shape.

Brown; apex of vertex and base of frons black, light over vertex, middle of pronotum and mesonotum, and along commissure. Tegmina brown, light along costa and between *Sc + R* and *M*.

*Female*.—Macropterous; length 4.6 mm.; tegmen 5.9 mm.

Similar to male in build and colour, but the tegmina are wider, being slightly widest across the nodal line; the apex rounded; the wings are broad, folded, and appear normal.

Described from two males and one female from Port Natal (*Gueinzus*, 1858).

CURTOMETOPUM, gen. nov.

Width of vertex nearly twice the length, the vertex and frons in profile forming an unbroken curve, the apex of the frons forming two rounded lobes and turned outward, base straight, well behind middle of eyes. Frons about as wide as long, sides arcuate, apex produced into two round lobes which are curved outward. In profile vertex and frons forming a curve, the frons being recurved at apex. Clypeus round, without carina. Antennae short, not reaching apex of frons; first segment wider than long, second segment considerably longer than wide. Hind margin of pronotum straight, tricarinate, lateral carinae straight, diverging posteriorly, reaching, or nearly reaching, hind



margin; mesonotum short, tricarinate, the lateral carinæ very obscure. Legs short, stout; hind basitarsus as long as the other two together, spur small, shorter than basitarsus, thin, concave on inner surface, convex on outer, hind margin with numerous small teeth.

The spur places this genus in the Delphacini. Type, *turneri*.

*Curtometopum turneri*, sp. n. (Figs. 22, 23.)

*Female*.—Length 2·3 mm.; tegmen 2 mm.

Brown; head and legs slightly lighter. Tegmina dirty white, opaque, veins same colour as membrane. Wings similar to tegmen, but with darker veins.

Described from one female from Port St. John, Pondoland (R. E. Turner, May 1923).

EUIDELLA, Fieber.

*Euidella* (?) *semifuscipennis*, sp. n. (Fig. 24.)

*Male*.—Macropterous; length 2·6 mm.; tegmen 4 mm.

Length of vertex 1·3 times the width at base, base 1·4 times the width at apex, projecting slightly beyond eyes, base slightly behind middle of eyes, head slightly wider than thorax; length of frons 2·5 times the width, sides nearly straight, subparallel, slightly constricted between eyes, fork of median carina nearly reaching to level of ocelli. Antennæ reaching well beyond middle of clypeus, first segment much longer than wide, apex slightly longer than base, slightly flattened, second segment 1·6 times the length of first, terete. Lateral pronotal carinæ divergently curved, not reaching hind margin. Legs fairly long, hind basitarsus as long as other two together; length of front femora 1·4 times that of front coxæ.

Full view of pygofer figured; lateral margin considerably cut away exposing the genital styles in lateral view, a stout pointed process on medio-ventral margin, curved upward.

Light stramineous; base of second and apex of first antennal segments dark, the darkness extending basad on the outer surface of the latter; darker between carinæ of frons with some lighter spots, pronotum slightly darker behind eyes, which extends over lateral portions of mesonotum, and the tegulæ, and extends to the apex of tegmen. Femora with thin longitudinal fuscous markings. Abdomen fuscous over middle of tergites; anal style fuscous. Tegmina

faintly stramineous, hyaline on anterior half, light fuscous on posterior half, covering clavus, *Cu* basal and apical cells to apex of *M* 3, being darkest along *M* 3, apices of all apical veins fuscous, otherwise veins same colour as membrane, granules small, inconspicuous; wings hyaline with dark brown veins.

*Female*.—Length 3.6 mm.; tegmen 5.4 mm.

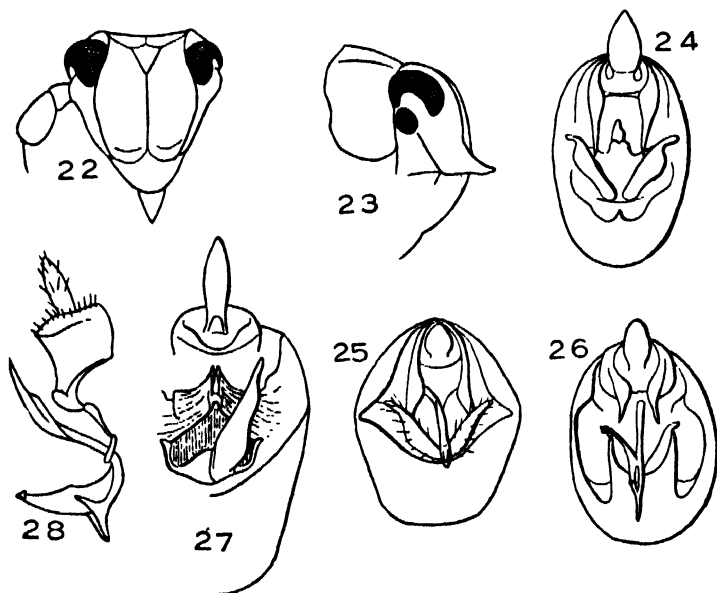


Fig. 22.—*Curtometopum turneri*, Muir, front view of head.

Fig. 23.—Ditto, lateral view of head.

Fig. 24.—*Euidella semifuscipennis*, Muir, full view of ♂ genitalia.

Fig. 25.—*Dicranotropis capensis*, Muir, full view of ♂ genitalia.

Fig. 26.—*Dicranotropis pondolandensis*, Muir, full view of ♂ genitalia.

Fig. 27.—*Dicranotropis anaxarchi*, Muir, full view of right half of ♂ genitalia.

Fig. 28.—Ditto, lateral view of anal segment and aedeagus.

Similar to male in form and colour.

Described from two males and three females from Port St. John, Pondoland (*R. E. Turner*, March, April 1923).

The vertex being longer than wide brings this species into *Chloriona*, but the wide head, narrow and straight frons, and general build make it impossible to place it there. The genus *Euidella* appears to be the best place for it.

## DICRANOTROPIS, Fieber.

*Dicranotropis capensis*, sp. n. (Fig. 25.)

*Male*.—Length 2 mm.; tegmen 3 mm.

Head wider than thorax; vertex slightly wider than long, base and apex subequal, apex hardly projecting beyond eyes, sides slightly arcuate, carinae normal; length of frons 1.7 times the width, sides slightly arcuate, median carina forked level with ocelli. Antennae reaching nearly to middle of clypeus, first segment distinctly longer than broad, second 1.6 times the length of first. Hind basitarsus as long as other two together; spur with many small teeth on hind margin. Lateral pronotal carinae diverging posteriorly, not reaching hind margin. Opening of pygofer wider than long, anal emargination shallow, anal angles obscure, lateral margins angular, ventral margin entire, simple. Genital styles small, widest on basal half, inner margin slightly convex, basal half of outer margin convex, apical half concave, apex narrow, rounded.

Light brown, carinae lighter, a few light spots on frons and genae; pronotum darkest behind eyes, where there is a light spot in the darker area; mesonotum darkest over lateral areas. Coxae and abdomen darker brown. Tegmina hyaline, slightly stramineous over clavus with commissure white, a fuscous spot at apex of clavus, a subcrescent-shaped mark extending from *M* fork over *Cu* then parallel to apical margin up to *M*2 apical vein, the dark marking proceeding along apical veins to apex, a small mark at node, and at apex of *R* and *M*1 apical veins a few light brown granules. Wings hyaline with brown veins.

Described from one male from Mossel Bay, Cape Province (R. E. Turner, February 1922).

This appears to be near to *Peregrinus lunulifer*, Melichar, which belongs to this genus or *Phyllodinus*, and not to *Peregrinus* (the coloration of the tegmina is similar to *Peregrinus maidis*); *Peregrinus vegetatus*, Melichar, is a *Delphacodes*. The genus *Asiracina*, Melichar, appears to be the same as *Phyllodinus*, Van Duzee.

*Dicranotropis pondolundensis*, sp. n. (Fig. 26.)

*Male*.—Length 2.1 mm.; tegmen 3.3 mm.

Vertex about as long as wide, carinae typical; median frontal carina forking nearly level with ocelli. Antennae reaching slightly beyond base of clypeus, first segment longer than wide, second considerably longer than first.

Lateral pronotal carina diverging posteriorly, not reaching hind margin. Hind basitarsus about as long as other two together, spur thin, fairly large, concave on inner surface, many fine teeth on hind margin. Front femora comparatively short, a little longer than the coxæ.

Opening of pygofer about as long as wide, anal emargination shallow, anal angles rounded, lateral margins entire, ventral margin produced into a thin flat plate, with the sides straight and the apex deeply and roundly emarginate, making the lateral angles stand up as two spines. Genital styles broadest on basal half, gradually narrowing to the small rounded apex; inner margin slightly sinuate, outer margin more distinctly so. *Ædeagus* long, thin, slightly flattened laterally, slightly curved ventrally, from the left side near apex a large strong spine projects basad and outward. Anal segment with two small strong spines on ventral surface, their bases fairly wide apart.

Stramineous; slightly darker between carinæ of head with a few lighter spots on frons between the carinæ. Tegmina clear hyaline or slightly opaquely white, apical veins dark brown, basad of nodal line veins same colour as membrane or very slightly stramineous. Wings hyaline with brown veins.

*Female*.—Length 3 mm.; tegmen 3·4 mm.

In build and colour similar to male, the abdominal tergites being slightly darker.

Described from one male and one female from Port St. John, Pondoland (*R. E. Turner*, April 1923).

*Dicranotropis anaxarchi*, sp. n. (Figs. 27, 28.)

*Male*.—Length 2 mm.; tegmen 2·8 mm.

Vertex slightly broader than long; length of frons about twice the width; median frontal carina forked about level with the ocelli, the arms of the fork being very close together. Antennæ reaching to base of clypeus, first segment longer than broad, second distinctly longer than first. Lateral pronotal carinæ nearly straight, slightly diverging posteriorly, reaching hind margin. Hind basitarsus longer than other two together; spur thin, tectiform, with about 18 small teeth on hind margin.

Head and thorax fuscous-brown, carinæ, sides of clypeus, and the lateral portions of pronotum yellow, the middle portion of pronotum and mesonotum lighter brown; coxæ and femora brown, tibiæ and tarsi yellowish; abdomen dark brown, yellow on metanotum and on pleura. Anal style

white or light yellow. Tegmina hyaline, fuscous over *Cu* and *R* cells, with a clear spot at apex of each and a larger one in middle of *M2* cell, veins of *R* fuscous, spreading slightly into membrane; granules brown, distinct, especially on basal portion. Wings hyaline with light veins.

The genitalia are very distinctive and are best understood by the figures. The anal segment is without armature. The diaphragm is long, the orifice at each corner is extended into a sinus curved upward; across the middle there is an inverted V-shape ridge of chitin. The dorsal margin is produced into an acute angle in middle with a deep cleft or sinus in the middle, the edges of this sinus thin and produced. The aedeagus is thin, curved and recurved, and slightly twisted. The anal segment is membranous, chitinized along the apical and basal margin.

Described from one male from Ceres, Cape Province (*R. E. Turner*, March 1921). The straight lateral pronotal carinae reaching the hind margin places this species outside the strict characterization of the genus, but it otherwise fits so well into the genus that it is best placed therein.

#### CHLORIONA, Fieber.

##### *Chloriona fuscipennis*, Muir.

Two males from Weenen, Natal (*H. P. Thomasset*, May 1924). This was previously known from Demarara River, British Guiana, South America. The writer has compared the two specimens with the type, and although they are slightly darker in colour they cannot be separated specifically.

#### PEREGRINUS, Kirkaldy.

##### *Peregrinus maidis* (Ashm.).

One male and two females of this widely-distributed species from Weenan, Natal (*H. P. Thomasset*, November, December 1923). These three specimens have the base of the median frontal carina projecting quite conspicuously.

#### NILAPARVATA, Distant.

##### *Nilaparvata nigratarsis*, sp. n. (Fig. 29.)

*Male*.—Macropterous; length 2.5 mm.; tegmen 3.5 mm.

Vertex slightly longer than wide, base about middle of eyes, projecting beyond eyes. Length of frons about three times the width, sides very slightly arcuate, median carina forked at extreme base. Antennae reaching to near middle

of clypeus, first segment longer than wide, second segment distinctly longer than first. Lateral pronotal carinae straight, diverging posteriorly, reaching or nearly reaching the hind margin. Two or three distinct spines on one side of hind basitarsus; spur with about 25 small teeth.

Opening of pygofer nearly round, margins entire, anal emargination fairly large, anal angles distinct but not produced. Diaphragm long, dorsal margin widely U-shape.

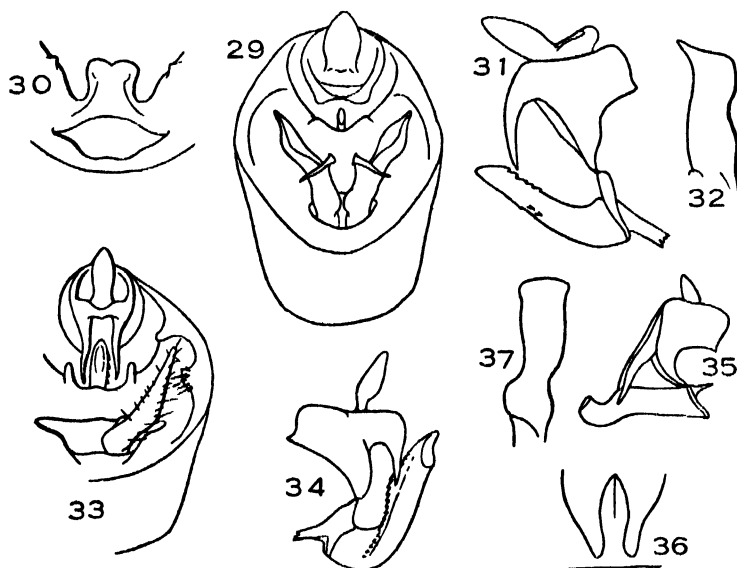


Fig. 29.—*Nilaparvata nigritarsis*, Muir, full view of ♂ genitalia.

Fig. 30.—*Sogata neovittacollis*, Muir, armature of diaphragm.

Fig. 31.—Ditto, anal segment and aedeagus.

Fig. 32.—Ditto, right genital style.

Fig. 33.—*Sogata albofimbriata*, Muir, full view of right side of genitalia.

Fig. 34.—Ditto, anal segment and aedeagus.

Fig. 35.—*Sogata nigricaudata*, Muir, anal segment and aedeagus.

Fig. 36.—Ditto, armature of diaphragm.

Fig. 37.—Ditto, right genital style.

The middle slightly raised. Genital styles complex and best understood from figure. Aedeagus not dissected.

Dark brown, the carinae of head and pronotum, the hind margin of pronotum and mesonotum, and the tegulae lighter. Legs lighter, tarsi darker, the spur light. Abdomen dark brown, yellow at base, on pleura, and on hind margin of apical segments. Tegmina hyaline, clear, commissure dark

brown expanding slightly into apical portion of clavus; cross-veins and all apical veins and apical margin dark brown, all other veins light; granules same colour as veins, small, obscure. Wings hyaline with veins light on basal portion and brown on apical.

Described from two males from Weenen, Natal (*H. P. Thomasset*, December 1923).

#### SOGATA, Distant.

*Sogata neovittacollis*, sp. n. (Figs. 30, 31, 32.)

*Male*.—Macropterous; length 2·7 mm.; tegmen 2·3 mm.

Length of vertex 1·5 times the width at base, base slightly wider than apex and considerably behind the middle of eyes. Length of frons 2·5 times the width, slightly widest on apical half, width of apex subequal to base; median carina simple. Hind basitarsus slightly longer than other two together; spur large, broad, thin, with about 20 small teeth on hind margin. Opening of pygofer about as long as broad, round, margins entire; anal emargination moderately shallow, anal angles distinct but not produced. Anal segment short, large, two large slightly curved spines on ventral surface with their bases far apart. Aedeagus in profile slightly curved, subtubular, slightly larger at base, a few small teeth on dorsal aspect at apex, and two or three on ventral surface near the middle. Genital styles flat, fairly broad, inner and outer margins slightly sinuous, apex truncate, inner corner produced.

Frons, middle of clypeus, anterior portion of genæ, anterior portion of vertex exterior to carinæ, medio-lateral portions of pronotum, lateral portions of mesonotum, coxæ of front and middle legs, and most of abdomen black or dark brown; sides of clypeus, posterior portion of genæ, antennæ, vertex except latero-apical areas, middle and lateral margins of pronotum, middle of mesonotum, legs, basal tergites, and pleura of abdomen yellow. Tegmina hyaline, slightly stramineous, commissure white with a dark mark near apex, fuscous over *M* fork, over cross-veins, over *Cu* apical cells, and over apical portion of *M* and *R* apical cells, a small hyaline spot at the apex of each of these fuscous cells; veins same colour as membrane, granules very small, bearing dark macrotrichia. Wings hyaline, slightly opaque, veins brown.

Female similar to male, but slightly larger.

Described from three males and four females from Port St. John, Pondoland (*R. E. Turner*, April 1923). This

species is near to *S. vittacollis* (Stål), but until that species is described more fully and the genitalia dissected it is better to place this under a different name.

*Sogata albofimbriata*, sp. n. (Figs. 33, 34.)

*Male*.—Length 1·7 mm. ; tegmen 2·3 mm.

Length of vertex 1·3 times the width at base, base slightly wider than apex, and placed about middle of eyes, apex protruding slightly in front of eyes. Length of frons 2·6 times the width, apex slightly wider than base, sides straight, subparallel. Antennæ reaching slightly beyond base of clypeus, first segment slightly longer than wide, second twice the length of first. Lateral pronotal carinæ nearly straight, diverging posteriorly, not quite reaching hind margin. Head distinctly narrower than thorax. Hind basitarsus a little longer than other two together ; spur thin, not as long as basitarsus, with about 20 small teeth on hind margin. The genitalia figured.

Genæ in front of transverse carinæ black or dark brown, extending on to the lateral portion of frons, rest of head and the antennæ yellow. Pronotum behind eyes and the lateral portions of mesonotum dark brown or black, the middle of pronotum and mesonotum and the lateral portion of pronotum and the tegulæ light yellow. Front and middle coxæ brown, rest of legs yellow, tarsi slightly fuscous ; abdomen dark brown. Tegmina hyaline, dark brown, the costal and subcostal cells slightly lighter ; commissure to apex of clavus white. Wings slightly fuscous with brown veins. Described from one male from Port St. John, Pondoland (*R. E. Turner*, March 1923).

*Sogata nigricaudata*, sp. n. (Figs. 35, 36, 37.)

*Male*.—Length 3·4 mm. ; tegmen 2·4 mm.

Head nearly as wide as thorax. Length of vertex 1·3 times the width, apex and base subequal, sides slightly arcuate, base slightly behind middle of eyes, apex projecting very slightly in front of eyes. Length of frons double the width, apex and base same width, sides slightly arcuate. Antennæ reaching beyond base of clypeus, first segment longer than wide, second about twice the length of first. Lateral pronotal carinæ nearly straight, diverging posteriorly, nearly reaching hind margin. Hind basitarsus as long as other two together, spur thin with eleven teeth on hind margin.

Opening of pygofer wider than long ; anal emargination

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large, anal segment sunk well within it, anal angles rounded large, produced but not curved inward; margins entire, rounded, diaphragm very short in middle, a long narrow process arises from the middle of dorsal margin, narrowly sublanceolate, in transverse section V-shape. Anal segment small with two large, laterally flattened spines, wide at base, gradually narrowed to acute apex. *Ædeagus* small, sub-tubular, slightly flattened laterally, with a curve at apex. Genital styles flat, fairly broad, apex truncate, margins sub-parallel on apical half, constricted on basal half.

Orange-yellow; fuscous across middle of abdominal tergites; pygofer and genital styles black, anal style yellow. Tegmina hyaline, clear; veins light yellow, apical veins slightly fuscous toward apices; wings hyaline with light brown veins.

Described from two male specimens from Port St. John, Pondoland (*R. E. Turner*, April 1923). This species appears to be close to the *Delphacodes nigripennis* group, to which *Sogata approximatus* approaches. The length of vertex and lateral pronotal carinæ keeps it out of *Delphacodes*.

*Sogata furcifera* (Horvath).

Six males and eight females from Port St. John, Pondoland (*R. E. Turner*, March, April 1923), and four females from Weenen, Natal (*H. P. Thomasset*, December 1923; April, October 1924). There is one female from Mossel Bay, Cape Province, which appears to be this species.

DELPHACODES, Fieber.

*Delphacodes propinqua* (Fieber).

Seven males and eleven females from Mossel Bay, Cape Province, one male from Aliwal North, and two males and one female from Queenstown, Cape Province (*R. E. Turner*). All these are macropterous. There are two brachypterous males and one brachypterous female from St. Helena, collected by Charles Darwin. These are the first brachypterous forms the writer has seen. This is one of the most widely distributed of the Delphacidae.

One female from Port St. John, Pondoland (*R. E. Turner*, May 1923), and three females from Umtata, Transkei (*R. E. Turner*, February, March 1923), appear to be this species, but without males one cannot be sure.

*Toya attenuata*, Distant, of Ceylon, appears to be this species.

*Delphacodes turneri*, sp. n.

*Female*.—Macropterous; length 3.4 mm.; tegmen 2.1 mm.

Head slightly narrower than thorax; width of vertex equal to length, base equal to apex, sides slightly emarginate, base about middle of eyes, apex projecting very slightly beyond eyes. Length of frons twice the width, base very slightly narrower than apex, sides straight, subparallel, or very slightly arcuate. Lateral pronotal carinae divergently curved, not reaching hind margin. Antennae reaching a little beyond base of clypeus, first segment longer than wide, second slightly longer than first. Spur not as long as hind basitarsus, thin, tectiform, many (about 25) minute teeth on hind margin.

Black or very dark brown; the middle carina of clypeus, lateral carinae of frons, fork at apex of vertex, the posterior half of pronotum, and basal angle of mesonotum white. Front and middle coxae and femora dark brown, tibiae and tarsi lighter, the femora having a lighter longitudinal mark and the tibiae a darker one, hind legs dark brown, apical portions of tibiae and tarsi lighter. Abdomen dark brown or black, lighter on pleura. Tegmina clear hyaline with three fuscous-brown marks, one at base of clavus, a broad band from middle of costa to hind margin of apex of clavus, another curved band from costa at stigma over nodal line to near hind margin, then curved to apex of *M* 1 and 2 apical veins, a small hyaline mark in apex of three *M* apical cells; veins same colour as membrane, granules small, obscure. Wings hyaline with light veins.

Described from five females from Port St. John, Ponderland (*R. E. Turner*, March, April 1923). The writer describes this species from females only, as it appears to be very distinctly coloured.

V.—Notes on the American Theclinae (*Lepidoptera*).

By PERCY I. LATHY, F.E.S.

WHEN Dr. Draudt finished his revision of this group in Seitz's work, I began to arrange Madame Fournier's collection according to it.

In the course of this work I discovered a certain number of errors committed by Dr. Draudt and also a number of new species and races; the object of this paper is to correct the former and describe the latter.

There is but little doubt that when the American Theclinae are thoroughly studied that Draudt's arrangement will be considerably modified, but the thanks of all Lepidopterists are due to him for having made a preliminary arrangement, and at least we have the names of all the described species grouped together and serving as a catalogue. A few species have been overlooked, but, on the whole, the work is very much superior to that of some of the other authors who have contributed to the American part of the work of Seitz.

The figures are unfortunately very poor and in many cases absolutely misleading, but fortunately most of the species are well figured in other works.

In the case of new species figured in Seitz these should be carefully checked by the description.

This necessity leads me to a few remarks concerning the dictum of the late Charles Oberthür, "Pas de bonne figure, pas de nom valable."

If this dictum were to be accepted it would mean the suppression of a vast quantity of names, names which are generally in use, for many unfigured species of Fabricius, Walker, and others have been identified with certainty and stand under these names in various public and private collections throughout the world. The fact that Oberthür could not understand a description does not prevent others from understanding them, and I think that many Lepidopterists will agree with me when I say that a species should never be identified from a figure only when there is also a detailed description accompanying it.

An artist is just as liable to make a mistake as anyone else, and I think that sometimes the proofs of figures are not so carefully examined as proofs of text, and sometimes text and figures do not agree. I quote an example from one of Oberthür's own works, 'Lépidopterologie Comparée, xi.': on page 97 he states that *Perisama henrica* differs from *P. lebasii*, inasmuch as the costal red line of the hind wing below is extended along the costa to beyond the outer discal black line, whereas in the latter species this costal red line terminates at the inner discal black line; on the pl. ccclviii. figs. 2971-74 are figured typical *lebasii* and three races; now the first two figures show the costal red line extended as far as the outer discal black one and in the last two far beyond! Are we to believe the figure or the description? Personally I think that the description is much more likely to be correct, as I do not think it at all probable that a Lepidopterist of Oberthür's distinction could possibly make such an error.

Another proof that a description is often more necessary than a figure is the fact that two closely allied species have often rested for years in collections under the same name; therefore, when one has not been able to distinguish between the specimens themselves, figures would probably have been quite useless without the description to indicate where the differences were. The fact is that Oberthür did not study descriptions; had he done so he would not have made such a mistake as in *Lép. Comp.* xi. pl. cecl. figs. 2903, 2904. There we have a male and female *Catagramma* figured as *C. lyca*. On page 62 we find Oberthür's statement that he cannot possibly understand the descriptions of three species of *Catagramma*, among which is *ærias*, G. & S.; if we look up this description, '*Biologia Centrali-Americana, Lep.*' p. 259, we find that we have to deal with a Central-American race that differs from the Mexican *C. lyca*, Boisdu, in having the apical half of the submarginal band of the hind wings tawny—this does not appear to me to be very difficult to understand, and a glance at the figure 2904 will show that there is exactly this distinction between it and the fig. 2903, consequently the figure 2904 represents *C. ærias*. Another proof that Oberthür did not trouble to read carefully is his statement, *Lép. Comp.* xix. 2<sup>ème</sup> Partie, p. 15, that the first number of the '*Bulletin of the Hill Museum*' figures every species described, and even all the local races. This statement is, of course, quite incorrect, as in the first new species described, *Euplaea peloroides*, p. 30, no figure is given, and repeatedly throughout the number a quantity of new forms are described without being figured. Oberthür also was not logical in his attitude towards this question; sometimes he would arbitrarily suppress names, such as *Catagramma mena*, *salamis*, *ærias*, all of which were easily to be identified by descriptions and to be confirmed by examination of the types which still exist, and, on the other hand, he retains all the names of Guenée, in spite of the vast majority being unfigured.

My own opinion is that no hard-and-fast rule can be laid down on this matter, as in some cases figures are, if not absolutely a necessity, of great help; while, on the other hand, cases exist where a figure is absolutely unnecessary, and it is a waste of time and money to give one: for instance, I wish to indicate an aberration of a well-known species which has its bands yellow instead of white—it is perfectly ridiculous to say that such a description cannot be understood without the aid of a figure.

The principal thing is to be able to identify with certainty the species described by an author, and if it can be done without a figure I do not see the necessity for one. The majority of the types of the species described since 1850 are easily accessible in the various public and private collections, and it must not be forgotten that all Lepidopterists have not the means to treat themselves to such expensive works as those of Oberthür; but, on the other hand, the majority of them have an opportunity of visiting the Museums, and all are assured of the collaboration of the authorities of these institutions when it comes to the question of determining a type. In the case of a vague description and loss of type, I think it much better to suppress such names than to have endless discussions as to what species they apply. I also consider that a certain allowance should be made for the figures that we find in some of the older authors, as in the case of the reproductions of Cramer, which, thanks to the discovery of the originals, are known to be very inaccurate, and where we find slight differences between the figure and specimens from the same locality that these should not be treated as different species, as is done in several instances by Houlbert in his "Monograph of the Castniidæ," Lép. Comp. xv.

In accordance with my principle that the main thing is to find out the certainty of an author's species, I asked my friend M. Le Cerf, of the Paris Museum, to try and find the types of Godart, and he kindly went through the collections and communicated me four of these, which will be dealt with later. Four other types have unfortunately been lost, and, as they cannot be identified by their descriptions, the names will have to be suppressed; they are the following:—*sinnis*, *nebis*, *gabelus*, and *ergens*. It is quite possible that other names are omitted from Draudt's list and that on examining other collections further modifications will have to be made, but this paper deals only with the facts that have come before my notice in arranging the collection of Madame Fournier.

*Eumæus minyas*, Hübn.

Draudt ignores the two names of Boisduval (Lép. Guat. ii. p. 13 (1870)) (*godartii* and *toxana*), and in consequence he renames the former race as *costaricensis*. Boisduval describes his *godartii* from a female; Godman and Salvin noticed the difference between the Costa Rican and

Guatemalan forms (Biologia Centr.-Amer., Lep. ii. p. 7 (1887)), but treated them both as *minyas*, Hübn.

The Guatemalan race is that described by Godart under the name of *toxæa* (Enc. Méth. ix., Suppl. p. 826, n. 1 (1823)). Up to the present all authors have treated this as a synonym of *minyas*, Hübn., but the type of *toxæa* is still in the Paris Museum, and one has but to compare it with Hübner's figure (Samml. Ex. Schmett. t. 97. ff. 1-4) to see that it is a different race.

The Costa Rican race must, of course, bear the name of *godartii*, Boisd., *costaricensis*, Draudt, sinking as a synonym.

There is nothing in Madame Fournier's collection that agrees exactly with Hübner's figure of *minyas*; the new race from Bolivia resembles it, inasmuch as the marginal spots of hind wing above are very small, but the blue is much duller than in Hübner's figure and the red spot at anal angle of hind wing below is almost obsolete.

As to *toxæa*, Boisd., I think that this is most probably the form described by Draudt under the name of *brasiliensis*. Boisdual gives Costa Rica as the locality, but this is very likely to be erroneous, as in the introduction to 'Lépidoptères du Guatemala' he states that in addition to the original collections of de l'Orza "et quelques espèces que feu M. Becker avait reçues de différentes mains."

*Eumæus minyas peruviana*, subsp. n.

A large form that resembles somewhat that of Costa Rica, but may be distinguished by greater extent of blue area of both wings above, the absence of apical white scaling on fore wing above and below, and the smaller red spot on inner margin of hind wings below.

32 ♂ ♂, 21 ♀ ♀, Chanchamayo, Peru.

*Eumæus minyas obsoleta*, subsp. n.

Nearest to *minyas minyas*, Hübn., but the blue area above more restricted and marginal green spots of hind wing above reduced and the red spot on inner margin of hind wing below almost obsolete.

2 ♂ ♂, Sara, Bolivia.

*Thecla coronata watkinsi*, subsp. n.

♀.—Differs from typical *coronata* in having marginal black border of fore wing above narrowing towards anal

angle where it terminates. The hind wing has the marginal black border very narrow, scarcely more pronounced than in the male of *regalis*; the upper red spot of anal angle smaller than in *coronata*.

The discal black bands of both wings below are inwardly edged with pale bluish green, forming a striking contrast to ground-colour.

1 ♀, Pichis Road, Peru, 4800 ft., xi., xii. 1919, C. Watkins.

*Thecla ganymedes*, Cram.

Draudt places *teresina*, Hew., as a synonym of *ganymedes*. This is, however, quite incorrect, as a comparison between the figure of the male in Seitz and that of Cramer (Pap. Exot. pl. xl. ff. C, D) will show.

Cramer's figure indicates a small species with well-developed androconial patch on fore wing, while Seitz shows a large species with no androconial patch, and this is confirmed by Draudt's description.

*Teresina* is quite a good species and the name must stand.

I have before me three males and two females of the species I take to be the true *ganymedes*, Cram., and these are the only specimens I have ever seen.

The males agree fairly well with Cramer's figure and the females are undoubtedly the same as that figured by Herrich-Schaeffer, Ex. Schmett. ff. 55, 56, under the name of *nobilis*; *bimaculata*, Möschl., is also a synonym.

*Thecla draudti*, sp. n.

♂.—*Upperside*. Fore wing differs from that of *ganymedes* in having the base bright greenish blue; the androconial spot in cell is bordered outwardly with four androconial streaks; the androconial patch on vein 1 near anal angle is long and does not extend halfway to vein 2, whereas in *ganymedes* this patch is short and extends to vein 2. Hind wing greenish blue.

*Underside*. Fore wing has the inner black band wider than the outer. Hind wing has the red area brighter than in *ganymedes* and is inwardly edged with black.

♀.—*Upperside*. Bright greenish blue instead of dull violet-blue of *ganymedes*.

*Underside*. Differs in the same manner as the male, and the green ground-colour of both wings is more golden.

This is the species from Columbia and Central America which is in all collections under the name of *nobilis*, H.-S.

*Thecla gabriela*, Cram.

*Papilio gabriela*, Cram. Pap. Ex. i. t. 6, C, D (1775).

Draudt treats *sponsa*, Möschl., as being a distinct species from this. I think, however, that there is but little doubt that it is the female of it.

*Thecla orsina*, Hew.

*Thecla orsina*, Hew. Ill. Diurn. Lep. p. 200, pl. lxxix. figs. 649, 650 (1875).

♂.—*Upperside*. Similar to *laudonia*, Hew., but ground-colour of a duller blue, androconial spot in cell black and apical black band of fore wing more pronounced.

*Underside*. Fore wing dull greyish brown clouded with whitish grey towards apex and on inner margin; an obscure discal dark line from costa to vein 2, the upper part of this line outwardly edged with whitish grey; marginal border somewhat darker than ground-colour. Hind wing similar to *laudonia*, but ground-colour dark brown with faint green tinge; the green markings much more obscure.

Rio Tono, Peru, 1200 ft., C. Watkins.

Hewitson described this species from a female from Bolivia. I take the specimen described to be the male of it; in the event of this conclusion being incorrect it will require a name, and should, I think, be regarded as a race of *laudonia*.

*Thecla drucei*, sp. n.

♂.—*Upperside*. Fore wing dull greenish blue, shading into dull brown towards apex and outer margin; large androconial black patch beyond cell. Hind wing dull greenish blue, anal lobe greyish brown slightly dusted with pale blue scales; tail as in *mavors*, Hübn.

*Underside*. Fore wing dull greyish green with blue and bronze reflections according to light; an obscure black point at end of cell; a discal narrow black band from costa to vein 2 and a submarginal faint dark line also from costa to vein 2. Hind wing: ground-colour as in fore wing; a narrow black band from just before middle of costa terminating in a point at junction of veins 4 and 5; beyond this a narrow black band which starts just below costa and meets a submarginal dark line on vein 3; a black line between veins 1 and 2 halfway along inner margin, anal lobe blackish.

1 ♂, Santa Catherina, Brazil.

This species is closely allied to *T. mavors*, Hübn., but may



be easily distinguished by its larger size, the more conspicuous androconial spot, much duller colour of both wings above and below, and also by the conspicuous markings of the underside. It is, I think, very probable that this may turn out to be a race of *T. paupera*, Feld., from Columbia.

*Thecla linus separata*, subsp. n.

The male differs from that of typical *linus* in having the androconial spot of fore wing above separated from the marginal border instead of being fused with it. The marginal blackish border of hind wing above is divided by a white line. The dark bands of the underside are narrower.

The female has a much narrower marginal black border on fore wing above and is entirely without cellular dark spot.

6 ♂♂, Rio Tono, Peru, 1200 ft., *C. Watkins* (type); 2 ♂♂, Chanchamayo, Peru; 2 ♂♂, 1 ♀, Matto Grosso.

*Thecla linus paraguayensis*, subsp. n.

Differs from the preceding in the androconial spot being somewhat smaller and still more divided from marginal blackish border and the dark bands on the underside much narrower.

12 ♂♂, Patino, Paraguay.

*Thecla dolyllas*, Cram.

*Papilio dolyllas*, Cram. Pap. Ex. ii. & iii. B, C (1779).

The figure given by Seitz is very misleading, the androconial spot being really of a chocolate-brown.

*Thecla narbal*, Stoll.

*Papilio narbal*, Stoll, Suppl. Cram. t. 38. ff. G, 6 F (1790).

Draudt treats *amplus*, Druce, and *fessa*, Möschl., as distinct species. I am of opinion that *amplus*, Druce, is the same thing as *narbal*, or at most an ill-defined local race, while *fessa*, Möschl., is nothing more than the female of *narbal*, Stoll.

*Thecla rocena major*, subsp. n.

♂. Differs from typical *rocena* in its much larger size, greater extent of and more brilliant blue of both wings above; also in the ground-colour of fore wings below being darker and the markings more pronounced.

2 ♂♂, Muzo, Colombia.

*Thecla atena*, Hew.

*Thecla atena*, Hew. Ill. Diurn. Lep. p. 92, t. 36. f. 93, t. 37. f. 101 (1866).

The female above is dull brown, both wings with faint bluish reflections towards inner margin; below as in male, but markings not so accentuated.

*Thecla obsoleta*, sp. n.

I propose this name for the species described and figured by Hewitson under the name of *punctum*, H.-S., Ill. Diurn. Lep. p. 109, pl. xl. figs. 132, 133. I take the true male of *punctum* to be the species figured by Hewitson, l. c. pl. lxxii. figs. 555, 556.

*Thecla essus*, H.-S.

*Thecla essus*, H.-S. Ex. Schmett. pl. xiv. figs. 59, 60 (1852-58).

It is curious that Draudt should make no mention of this species, as he includes in his work all the others that are figured on the same plate.

Madame Fournier has two specimens, both males, from the lower Marouï, French Guiana.

*Thecla lycabas*, Cram.

*Papilio lycabas*, Cram. Pap. Ex. ii. t. cxvii. E (1770).

Draudt places *terentia*, Hew., as a synonym of this; on comparing Hewitson's figure with that in our copy of Cramer, it struck me that unless the latter was very badly reproduced this could hardly be the case.

Captain Riley, of the Natural History Museum, was kind enough to compare Hewitson's type with Cramer's original figure, and he is of the opinion that these are two distinct species.

*Thecla sophocles*, Fabr.

*Papilio sophocles*, Fabr. Ent. Syst. iii. i. p. 267. n. 31 (1793).

I cannot understand why Draudt should place *basalides*, Hübn., as a synonym of this, more especially as he afterwards, p. 807, treats it as a species.

*Thecla strophius*, Godt.

*Papilio strophius*, Godt. Enc. Meth. ix. p. 632. n. 56 (1823).

The type of this species is still in the Paris Museum. The specimen is a male, and it is identical with the species described by Hewitson under the name of *panchæa*. Godart's name, of course, has the priority.

*Thecla strephon occidentalis*, subsp. n.

♂. Differs from the typical form in being larger and more brilliant blue above. The ground-colour of the under-side is much paler and the androconial spot of fore wing much darker.

♀. Duller and less extended blue than in the male on both wings above. Below as in male, but, of course, no androconial spot.

6 ♂♂, 1 ♀, Rio Tono, Peru, 1200 ft., *C. Watkins*; 1 ♂, Chanchamayo, Peru.

*Thecla cyllarus*, ab. *xanthica*, nov.

♂. Differs from the typical form in having the spots at anal angle of hind wing below bright orange instead of red.

1 ♂, Lower Maroni, French Guiana.

*Thecla cyllarus reducta*, subsp. n.

♂. Differs from the typical form in having the anal red spot of hind wing below very much smaller.

5 ♂♂, Rio Tono, Peru, 1200 ft., *C. Watkins*; 1 ♂, La Merced, Peru, 3000–4500 ft., xi., xii. 1919, *C. Watkins*; 1 ♂, Chanchamayo, Peru.

*Thecla phoster parvipuncta*, subsp. n.

This race differs from the typical form in exactly the same manner that *reducta* differs from *cyllarus*.

1 ♂, 1 ♀, Rio Tono, Peru, 1200 ft., *C. Watkins*.

*Thecla ambrax septentrionalis*, subsp. n.

The race from Colombia and Central America differs from the typical Brazilian form, inasmuch as the apical black area of fore wings above is much reduced, and consequently the androconial spot is widely separated from it by the blue ground-colour; the androconial spot is also very much larger than in typical *ambrax*. A comparison between the figures given by Westwood (Hew. Gen. Diurn. Lep. t. 75. f. 7) and Godman and Salvin (Biologia Centrali-Americana, Lep. t. 55. fig. 5) will illustrate the difference.

*Thecla selina*, Hew.

*Thecla selina*, Hew. Ill. Diurn. Lep. p. 118, pl. 1. fig. 255.

I am inclined to think that *meridionalis*, Draudt, described as a form of *pholeus*, is nothing more than the male of

*selina*. I have before me a series of males from Peru and several localities on the Amazon, all of which agree with *meridionalis*, and a series of females from corresponding localities, all of which agree with *selina*, and it seems to me to be a too extraordinary coincidence that two species should exist side by side of which we know only the male of the one and only the female of the other.

*Thecla orcynia*, Hew.

*Thecla orcynia*, Hew. Ill. Diurn. Lep. p. 121, pl. 1. figs. 262-265.

Draudt regards *anthracia*, Hew., and *aunia*, Hew., as synonyms. This view is incorrect, as a glance at the figures (*l. c.* pl. lxxv.) will show that, though the two latter are closely allied, they are very different from *orcynia*.

I have before me several specimens of both sexes of *anthracia*, and Hewitson was wrong when (*l. c.* p. 167), in commenting upon his description of *aunia*, he considered the absence of triangular white spot at end of band of fore wing to be a sexual distinction, as the six females that I have examined possess this mark as in the male.

I have also one specimen which agrees quite well with Hewitson's figure of *aunia*. As the type of *anthracia* is from Brazil and that of *aunia* from Venezuela, and Madame Fournier's specimens are respectively from Peru and French Guiana, I am of opinion that *aunia* and *anthracia* are distinct species and that both names should stand.

*Thecla tristis*, sp. n.

♂.—*Upperside* of both wings uniform dark brown; a faint androconial spot at end of cell of fore wing.

*Underside*. Ground-colour of both wings paler than above. Fore wing crossed by a postdiscal, slightly broken, white line and a submarginal white line. The first of these inwardly edged and the second outwardly edged with dark brown. Hind wing crossed by discal white line sharply angled towards anal angle, forming the characteristic W. This line inwardly edged with brown; small red patch between tails; this patch contains a black spot on its marginal edge and is inwardly edged with dark brown, anal angle edged with red. Both wings with a narrow marginal white line disappearing before apex.

1 ♂, Nivac, Matto Grosso.

This species appears to be allied to *epopea*, Hew., by the underside markings, which are almost identical, but the dull brown colour of both wings above distinguished it from this and allied species.

*Thecla vesper*, Druce.

*Thecla vesper*, Druce, Trans. Ent. Soc. Lond. 1909, p. 436, pl. xi. fig. 8.

♀.—*Upperside*. Fore wing dark brown with dull blue reflection from inner margin to cell. Hind wing as in male, but duller in colour.

*Underside*. As in male, but the bands not so sharply accentuated.

1 ♀, Rio Tono, Peru, 1200 ft., *C. Watkins*.

*Thecla bellera*, Hew.

*Thecla bellera*, Hew. Ill. Diurn. Lep. p. 194, pl. lxxvii. (1875).

This name may be retained for the female form of *beon*, Cram., which has no blue above.

*Thecla echion*, Linn.

*Papilio echion*, Linn. Syst. Nat. i. 2, p. 788. n. 224 (1767).

Draudt treats *crolus*, Cram., as a synonym of *echion*. *Crolus* is, however, a distinct species and *echion* is the species figured by Draudt under the name of *basalides*, Hübn. On examining the type of *megarus*, Godt., I found it to be identical with *echion*. The name *ziba*, Hew., may be retained for the aberration without blue markings above.

*Thecla eurytulus*, Hübn.

*Tmolus eurytulus*, Hübn. Samml. Ex. Schmott. ii. pl. xc. figs. 1-4 (1816-1841).

The figure in Seitz has not the slightest resemblance to those of Hübner—whether it is simply badly executed or is that of another species, I cannot say.

I consider *argona*, Hew., to be a synonym of *eurytulus*.

*Thecla eurytulus nigra*, subsp. n.

♂.—*Upperside*. Similar to typical form, excepting that marginal blue markings of hind wing are more developed and the abdomen is black.

*Underside*. Fore wing with the markings more obscure and ground-colour suffused with greyish. Hind wing has all the markings very obscure, and it is difficult to see the traces of the distinct dark spots of the typical form. The red spots are replaced by very small faint yellow ones. The ground-colour strongly suffused with greyish.

1 ♂, Tucuman, Argentine, 9. vi. 1922.

*Thecla thius*, Hübn.

*Hyrenus thius*, Hübn. Zutr. Ex. Schmiett. ff. 743, 744 (1832).

The type of *bazochii*, Godt., is in the Paris Museum, and it is undoubtedly the same species as *thius*.

*Theclopsis eryx occidentalis*, subsp. n.

♂.—*Upperside* of both wings with blue more extended than in typical *eryx*.

*Underside*. Ground-colour much duller and black patch below cell much smaller, only being extended about halfway towards vein 1.

♀.—*Upperside* rather brighter blue and below the ground-colour of both wings paler and anal red spots of hind wing smaller.

8 ♂♂, 2 ♀♀, Rio Tono, Peru, 1200 ft., *C. Watkins* (type); 1 ♂, Chanchamayo, Peru, 3000–4000 ft., xi., xii. 1919, *C. Watkins*.

*Lamprospilus decorata*, sp. n.

♂.—*Upperside*. Fore wing dark brown, a large white patch on basal half on inner margin extending upwards as far as cell. Hind wing dark brown crossed by a wide discal white band from costa to vein; base and inner margin greyish; at anal angle two square bright blue patches divided by vein 2.

*Underside*. Fore wing brown, a white patch on inner margin as above, beyond cell a straight oblique white line from costa to vein 2, a submarginal white line. Hind wing brown, a conspicuous broad white band from costa to vein 3; between this and inner margin the characteristic **W** white mark of the *Thecla*—this mark inwardly edged with dark brown; a submarginal white line outwardly edged with dark brown; a terminal dark line inwardly edged with white, on lower half a red spot between tails, this spot containing a small black one on outer edge; anal lobe black edged with white above; tails black tipped with white.

1 ♂, Oxapampa, Peru.

Allied to *L. nicetus*, Feld., but may easily be distinguished by the absence of the postdistal white spot of fore wing and the presence of the anal bright blue patches of hind wing above.

VI.—On the Identity of *Catagramma idas*, Müll. (Lep.).

By PERCY I. LATHY, F.E.S.

It is very curious that this species, the first *Catagramma* to have been described, should have been overlooked by all three authors who have written on the *Catagrammas*, as neither Guenée, Rober, nor Oberthür make any mention of it, in spite of its name being included in the Supplement to Kirby's 'Catalogue,' p. 737.

When studying the *Catagrammas* at the Natural History Museum, I found a sketch of Müller's figure in one of the drawers, and it was considered to be the female of *C. brome*, Boisd. This, however, is a Colombian species, while Müller gives Essequibo as the locality of *idas*. On turning up Müller's black-and-white figure I found it exceedingly badly done, as one of the fore wings below has the base black, while in the other it is not so; fortunately, however, there is a description, in which it is stated that the discal patches of fore wings above are red ("rosenroth"). Therefore there is no doubt as to its identity. It is the same species that was described by Oberthür from a female from French Guiana, and redescribed later on by Kaye, who made known the male.

The species appears to be exceedingly rare. The first specimens that I ever saw were two females from British Guiana that were received by the late Mr. H. J. Adams about 1896, and I remember at that time we thought that they might possibly be the females of *C. brome*. These specimens are still in the Adams Collection at the Natural History Museum; Oberthür appears to have had one female, and two males and a female from French Guiana in the Joicey Collection served Kaye for his description of *polypygas*. Madame Gaston Fournier possesses a pair from the same locality, and in the collection of Mr. Schmassmann of Enfield are two males from British Guiana which differ from those of French Guiana, inasmuch as the discal red patch of fore wing above is somewhat smaller.

The synonymy is as follows:—

*Papilio idas*, Müller, *Natursystem*, i. p. 633, pl. xix. fig. 11 (1774).

*Catagramma maronensis*, Oberth. *Lep. Comp.* xi. p. 66, pl. cccli. fig. 2909 (1916).

*Catagramma polypygas*, Kaye, *Ent. Rec.* xxxi. no. 2, p. 26 (1919).

VII.—On *Fusulina* and other Organisms in a partially Calcareous Quartzite from near the Malayan—Siamese Frontier.  
By R. BULLEN NEWTON, I.S.O., F.G.S., Geological Department, British Museum (retired).

[Plates II. & III.]

### Introduction.

The fossils referred to in this paper have been submitted to me for examination and report by Mr. J. B. Scrivenor, M.A., the Government Geologist of the Federated Malay States. They were discovered by two native collectors in northern Malaya at a place known as Goa Laman Maling, which is quite close to the south-western frontier of Siam, and which, according to letters from Mr. E. S. Willbourn, the Assistant-Geologist of the same country, is "near boundary stones 9 and 10 in the extreme north of Perlis, or more accurately about 600 yards west from boundary stone 10." The region is described as "rolling country, with hills only 100 feet or so in height, and various exposures show calcareous sandy shales and quartzite with a varying amount of calcareous cement. The quartzite usually stands out as the hills (=Goa)." Further information from Mr. Willbourn mentions that "the strike of the beds is approximately north and south and the dip is nearly vertical. The unweathered rock is hard quartzite with calcareous cement, and the fossils in it are not very conspicuous. The tests are calcite; weathering replaces this by sandy clay." This hard and heavy quartzite is of greyish and sometimes of a light sandy-colour, whereas its exposed surfaces, being largely limonitic, are soft and decomposing, thus yielding a fine ochreous-like powder, besides presenting strong weathering tints of red and yellow. From thin slices under the microscope, the unweathered rock is observed to be of fragmentary structure, whilst with the aid of the polarizer the brightest colours are displayed, thus indicating a structure with a considerable percentage of siliceous constituents. The matrix is full of fossiliferous remains but imperfectly preserved, those seen on the weathered surface being generally the best defined. The most abundant organism observed belongs to the foraminiferal genus *Fusulina*, whilst others include remains of corals (*Stenopora*), Crinoidal stem-fragments, Polyzoa (*Fenestellidae*), and imperfect casts of Pelecypod valves. The presence of *Fusulina* is of chief



importance, however, in endeavouring to arrive at stratigraphical results, because that genus is characteristic of the youngest Carboniferous deposits (Uralian) as well as of beds of Permian age, thus forming a definite Palæozoic horizon which is often referred to as Uralian-Permian or Permo-Carboniferous. Moreover, its occurrence is usually so prolific in rocks of European and other countries that the term "*Fusulina* Limestone" is well known in Palæozoic chronology.

It is interesting to note that Mr. Scrivenor (Journ. Geology (Chicago, 1923), vol. xxxi. p. 557) has already reported the occurrence of "poorly preserved *Fusulinidæ*" in a Chert at Perlis, which probably refers to the specimens described in the present paper.

Since its first description our knowledge of this genus and its allies, all of which belong to the *Fusulinidæ*, has been greatly extended, so that a considerable literature exists at the present day dealing with the microscopical characters of these organisms, together with their geological and geographical distribution.

Among the countries over which the *Fusulinidæ* extend may be mentioned Europe (Russia, Caucasus, Spain, Italy, Carniola and Carinthia, Southern Alps, etc.); Asia (Japan, China, Indo-China, Korea, Afghanistan, Chitral, Pamirs, Salt Range, Persia, etc.); North America (British Columbia, California, Nebraska, Texas, etc.); Arctic America (Spitzbergen, Prince Albert Land, etc.); Central America (Guatemala and British Honduras); South America (Brazil, Peru, Bolivia); Sumatra, British Malaya, and Siam.

The following list of literature contains the more prominent papers on this strictly Palæozoic group of organisms:—

- ABICH. Mém. Ac. Imp. Sci. St. Pétersbourg, 1858, ser. 6, part 1, vol. vii. pp. 430, 528, pl. iii. figs. 13. (*Fusulina spherica*, Abich = *Fusulinella*, Möller: Caucasus.)
- CARPENTER, PARKER, and JONES. Introduction to the Study of Foraminifera, 1882, pp. 304-307, pl. xii. figs. 24-29.
- DEPRAT. "Étude des *Fusulinidés* de Chine et d'Indochine et Classification des Calcaires à *Fusulines*." Mem. Serv. Géol. Indochine, 1912, vol. i. Fasc. 3, pp. 77, pls. i.-ix.
- . "Les *Fusulinidés* des Calcaires Carbonifériens et Permians du Tonkin, du Laos et du Nord-Annam." *Ibid.* 1913, vol. ii. Fasc. 1, pp. 70, pls. i.-x.
- . "Étude des *Fusulinidés* du Japon, de Chine et d'Indochine." *Ibid.* 1914, vol. iii. Fasc. 1, pp. 1-46, pls. i.-viii.
- . "Les *Fusulinidés* des Calcaires Carbonifériens et Permians du Tonkin, du Laos et du Nord-Annam." *Ibid.* 1915, vol. iv. Fasc. 1, pp. 30, pls. i.-iii.
- DIENKIE. "Anthracolithic Fossils of the Shan States." Pal. Indica, Mem. Geol. Surv. India, 1911, n. s., vol. iii. Mem. 4, p. 44, pl. vi. fig. 5. (*Fusulina*.)

- DOUVILLÉ, H. "Mollusques Fossiles." J. de Morgan's 'Mission Scient. Perse,' 1904, vol. iii. part 4, pp. 228-230, pl. xxvii. figs. 7-16. (*Fusulinella*, Permo-Carboniferous.)
- . "Les Calcaires à Fusulines de l'Indo-Chine." Bull. Soc. Géol. France, 1907, ser. 4, vol. vi. pp. 576-587, pls. xvii., xviii.
- DRYSDALE. (*Fusulina*, British Columbia, Canada.) Guide Book, No. 8, part 2, Geol. Surv. Dept. Mines, Canada, 1913, pp. 239, 240.
- DYHRLENFURTH, G. "Die Asiatischen Fusulinen." 'Palæontographica,' 1909, vol. lvi. pp. 137-176, pls. xiii.-xvi.
- FISCHER, DE WALDHEIM. Bull. Soc. Imp. Nat. Moscou, 1829, vol. i. no. 10, p. 330; and 'Oryctographie de Moscou,' 1830, pl. xiii. pp. 126, 127. (*Fusulina*.)
- GRINITZ. "Zur Geologie von Sumatra." 'Palæontographica,' 1876, vol. xxii. pp. 399-400. (*Fusulina verbeeki*=*Schwagerina*.)
- GEMMELLARO. La Fauna dei calcari con *Fusulini* della Valle del Fiume Sosio (Palermo). 1887.
- HAYASAKA. "Fauna Anthracolithic Limestone of Omi-Mura, Echigo (Japan)." Sci. Repts. Tôhoku Imp. Univ. Japan, 1924, ser. 2 (Geology), vol. viii. no. 1, pp. 3-19, pls. ii., iii. (*Fusulinidæ*.)
- HAYDEN. "Fusulinidæ from Afghanistan." Rec. Geol. Surv. India, 1909, vol. xxxviii. pp. 230-256, pls. xvii.-xxii.
- KATZER. Grundzuge der Geologie des unteren Amazonas-Gebietes, 1903, p. 162. (Leipzig.) *Fusulina* from San Paulo, Brazil.
- LANGE. "Eine Mittelpermische Fauna von Guguk Bulat (Sumatra)." Verhand. Geol.-Mijn. Genoots. Nederland Koloniën, 1925, Geol. Ser. vol. vii pp. 213-294, pls. i.-v. (*Foraminifera*, etc.)
- MEKK. "Palæontology." Vol. i. Geol. Surv. California (Whitney), 1864, pp. 3, 4, pl. ii. figs. 1, 2. (*Fusulina*.)
- MÖLLER. "Die Spiral-gewundenen Foraminiferen des Russischen Kohlenkalks." Mém. Acad. Imp. Sci. St. Pétersbourg, 1878, ser. 7, vol. xxv. no. 9, pp. 1-147, pls. i.-xv.
- NORTLING. "Carboniferous Fossils from Tenasserim (*Schwagerina oldhami*, Noetling)." Records Geol. Surv. India, 1893, vol. xxvi. pp. 97, 98, pl. —. fig. 1.
- ORBIGNY. Murchison's 'Geologie de la Russie d'Europe,' 1845, vol. ii. p. 16, pl. i. fig. 1. (*Fusulina*.)
- OZAWA. "On some Species of *Fusulina* from Honan, China." Japanese Journ. Geol. Geogr. 1923, vol. ii. no. 2, pp. 35-39, pl. v. figs. 1, 2.
- . "On the Classification of Fusulinidæ." Journ. Coll. Sci. Imp. Univ. Tokyo, 1925, vol. xlv. art. 4, pp. 26, pls. i.-iv. and text-figures.
- REED, F. R. C. "Upper Carboniferous Fossils from Chitral and the Pamirs." Pal. Indica, Mem. Geol. Surv. India, 1925, n.s., vol. vi. Mem. 4, pp. 9-11, pl. i. figs. 1-12. (*Fusulinidæ*.)
- ROEMER. "Ueber eine Kohlenkalk-Fauna der Westküste von Sumatra." 'Palæontographica,' 1880, vol. xxvii. p. 4, pl. i. figs. 1-2. (*Fusulinidæ*.)
- SALTER. "Account of the Arctic Carboniferous Fossils (*Fusulina hyperborea*)." Belcher's 'The Last of the Arctic Voyages,' 1855, vol. ii. pp. 380, 381, pl. xxxvi. figs. 1-3.
- SAPPER. "Grundzüge der physikalischen Geographie von Guatemala." Petermann's Mitt. Ergänzungsheft, 1894, vol. xxiv. no. 113, p. 8. (*Fusulina granum-avenæ*, Roemer.)
- . "Ueber Gebirgsbau und Boden des Nördlichen Mittelamerika." Petermann's Mitt. Ergänzungsheft, 1899, vol. xxvii. no. 127, p. 61. (*Fusulina granum-avenæ*, Roemer, Guatemala and British Honduras.)

- SCHELLWIEN. "Die Fauna des Karnischen Fusulinenkalks." 'Palaeontographica,' 1898, vol. xlv. pp. 237-282, pls. xvii.-xxiv. (Upper Carboniferous.)
- . "Paläozoische und triadische Fossilien aus Ostasien." Futterer's 'Durch Asien,' 1903, vol. iii. pp. 129, 151, pls. iii., v. (Fusulinidae.)
- . "Die Fusulinen des Russisch-Arktischen Meeresgebietes." 'Palaeontographica,' 1908, vol. lv. pp. 145-194, pls. xiii.-xx.
- SCHWAGER. "Carbonische Foraminiferen aus China und Japan." Richthofen's 'Beitr. Paläontologie von China,' 1888, vol. iv. pp. 106-159, pls. xv.-xviii.
- . Waagen's "Salt-Range Fossils," Protozoa, *Fusulina*. Pal. Indica, Mem. Geol. Surv. India, 1887, ser. 13, part 7, pp. 983-990, pls. cxxvi.-cxxviii. (*Productus* Limestone.)
- SCRIVNER. "The Structural Geology of British Malaya." Journ. Geology (Chicago), 1923, vol. xxxi. p. 557. (Fusulinidae.)
- STACHE. "Fusulinenkalk aus Oberkrain Sumatra und Chios." Verhandl. k.-k. Geol. Reichs. 1876, pp. 369-371. In a translation of this paper printed in the Geol. Mag. 1877, p. 165, the island of Borneo is given by mistake for Sumatra, hence some authors still wrongly quote Borneo as a locality for *Fusulina*.
- STAFF. "Beiträge zur Kenntnis der Fusuliniden." Neues Jahrb. 27 Beil.-Band, 1909, pp. 461-508, pls. vii., viii.
- . "Die Fusulinen (Schellwienien) Nordamerikas." 'Palaeontographica,' 1912, vol. liz. pp. 157-191, pls. xv.-xx. and text-figures.
- STAFF and WEDEKIND. "Der oberkarbone Foraminiferens aproplit Spitzbergens." Bull. Geol. Inst. Upsala, 1910, vol. x. pp. 81-123, pls. ii.-iv.
- STEINMANN. "A Sketch of the Geology of South America." American Naturalist, 1891, p. 856. An Upper Carboniferous Fauna with *Fusulina* is known from Peru, Bolivia, and Brazil.
- SURSS. "Ueber das Vorkommen von Fusulinen in den Alpen." Verhandl. k.-k. Geol. Reichs. 1870, pp. 4, 5.
- TRAUTSCHOLD. "Die Kalkbrüche von Mjatschkowa eine Monographie des oberen Bergkalks." Mém. Soc. Imp. Nat. Moskau, 1879, vol. xiv. pp. 141, 142, pl. xvii. fig. 2. (*Fusulina*.)
- VERBECK and FENNEMA. Description géol. Java et Madoura, 1890, vols. i., ii. pl. i. pp. 1131-1136. (Fusulinidae of Sumatra.)
- VERNEUIL and COLLOMB. "Coup d'œil sur la constitution géologique de quelques provinces de l'Espagne." Bull. Soc. géol. France, 1853, ser. 2, vol. x. p. 125. (*Fusulina cylindrica*.)
- WALDHEIM, *see* FISCHER.
- YABE. "*Fusulina*, with Notes on a *Fusulina*-Limestone from Korea." Journ. Coll. Sci. Imp. Univ. Tokyo, 1906, vol. xxi. art. 5, pp. 1-36, pls. i.-iii.
- . "Das Strukturproblem der Fusulinenschale." Beitr. Pal. Geol. (Oest.-Ungarns Oriens (Wien), 1910, vol. xxiii. pp. 273-281. Ten text-figures.

### Notes on the Fossils.

#### FORAMINIFERA.

#### *Fusulina* cf. *granum-avena*, Roemer.

(Pl. II. figs. 1C, 2, 3C, 4, 5, 6.)

*Fusulina granum-avena*, Roemer, Palaeontographica, 1880, vol. xxvii. p. 4, pl. i. fig. 2; Sapper, Petzmann's Mitteil. Ergänzungsheft, 1894, vol. xxiv. no. 113, p. 8 (Guatemala); Verbeek, Desc. Géol.

JAVA, Madoura, 1890, vol. i. pl. i. figs. 1-10, and vol. ii. pp. 1131-1133 (Sumatra); Sapper, Petermann's Mitteil. Ergänzungsheft, 1899, vol. xxvii. no. 127, p. 64 (Guatemala and British Honduras); Deprat, Mém. Surv. Géol. Indochine, 1912, vol. i. Fasc. 8, part 3, p. 26; *ibid.* 1913, vol. ii. Fasc. 1, p. 12; *ibid.* 1914, vol. iii. Fasc. 1, Mem. 3, p. 18 (Indo-China).

*Remarks.* The fossils here determined as being related to Roemer's *Fusulina granum-avena* from the "Kohlenkalk" of Sumatra appear, also, to resemble *F. cylindrica* of Fischer de Waldheim from the Russian Carboiferous, a fact making it possible that the Malay examples may be of nearly corresponding structure to both those described species. It has long been recognised that almost insuperable difficulties exist when attempting specific determinations of the true *Fusulina*. It is observable that the Malay specimens present a greater length than either *cylindrica* or *granum-avena*, whilst the outer aspect is rather more parallel-sided and the terminal extremities are rounded rather than pointed; externally, also, the three forms are furnished with the usual longitudinal furrows of the genus (Pl. II. fig. 2). So far as the microscopical characters are concerned, they all share a very similar internal structure. Thus, the transverse sections (Pl. II. figs. 5, 6) show six, seven, or more convolutions bordered by a well-defined wall, from which proceed a regular series of septa that mark out the comparatively large and more or less rectangular chambers now penetrated and rendered distinct by a white calcitic infiltration (Pl. II. figs. 5, 6), the initial chamber being large and spherical. Longitudinal sections (Pl. II. figs. 3, 4) display very clearly the several convolutions, besides showing the vesicular aspect of the chambers as they reach the outer surface, a character delineated by Verbeek in his structural details of *F. granum-avena*. A longitudinal fragment (Pl. II. fig. 3) well illustrates a series of minute undulating lines assuming a quincuncial pattern, lying just beneath the surface and forming part of the septal region, thus constituting a structure of trellis-work appearance as originally pointed out by Verbeek.

*Dimensions.* Length (max.) = 19 mm., diameter (max.) = 3 mm.

Briefly, it may be mentioned that the generic name *Fusulina* was established by Fischer de Waldheim in 1829\* to include his two species, *F. cylindrica* and *F. depressa*, which were found in the Mjatschkowa† limestone of the neighbourhood of Moscow, Russia. No great differences

\* Bull. Soc. Imp. Nat. Moscou, 1829, vol. i. no. 10, p. 330; and 'Oryctographie de Moscou,' 1830, pl. xiii. pp. 126, 127.

† Or Mjatschkova.

separate these two forms—in fact, they have been united for many years under *F. cylindrica*, the species which has long been recognised as the type of the genus.

The original diagnosis of *Fusulina* stands thus :—“à ouverture formant une fente longitudinale ; test en forme de fuscau, formé par des loges oblongues qui entourent l'axe en spirale.”

(The typical form measures :—Max. length and diameter about  $6 \times 1.5$  mm.)

*Doliolina* cf. *lepida*, Schwager. (Pl. II. fig. 7.)

*Schwagerina lepida*, Schwager, Richthofen's Beitr. Paläontologie von China, 1883, pp. 138-140, pl. xvii. fig. 18, pl. xviii. figs. 1-14.

*Möllerina lepida*, Schellwien, Paläontographica, 1898, vol. xlv. p. 238, non *Möllerina*, Ulrich, 1886.

*Doliolina lepida*, Deprat, Mém. Serv. Géol. Indochine, 1912, vol. i. Fasc. 3, pp. 45, 46, pl. v. fig. 10, pl. vi. figs. 1-3 ; *ibid.* 1913, vol. ii. Fasc. 1, p. 49, pl. x. fig. 18 ; *ibid.* 1914, vol. iii. Fasc. 1, p. 22, pl. iii. figs. 12-14 ; *ibid.* 1915, vol. iv. Fasc. 1, p. 27 ; Ozawa, Journ. Coll. Sci. Imp. Univ. Tokyo, 1925, vol. xlv. art. 4, pp. 17, 18, 25, pl. iv. fig. 4 ; and *ibid.* 1925, vol. xlv. art. 6, p. 53, pl. ii. fig. 8b.

*Remarks.* The specimen referred to under the above determination, of which the figures given are enlarged four diameters, corresponds in the main with Schwager's original illustrations (pl. xviii. figs. 4, 5) of Chinese examples occurring in beds then understood to be Carboniferous, but which are now recognised as of Permian age.

The chief Malay specimen, as seen in the limestone section now figured (Pl. II. fig. 7 A), presents a test partaking of the same oblong cylindroid contour as displayed in Schwager's figures, having more or less rounded extremities, whilst internally the structure consists of relatively thick, equidistant, somewhat irregular, transverse, mural divisions, crossed by thin longitudinal septa which together form closely arranged rectangular chambers, in which latter character it differs from the original *D. lepida*, as that form possesses chambers of quadrangular shape. Further objects in this section are evidently examples of the same organism, although too obscurely darkened by mineralization for the exhibition of determinable characters.

*Dimensions.*  $4 \times 2$  mm.

From its peculiar barrel-shaped test, instead of being subglobular as in the true *Schwagerina*, besides exhibiting other differences of structure, Schellwien separated this species from Möller's genus *Schwagerina*, under which Schwager had originally recognised the form, and so gave it the new name of *Möllerina*, although that again had to be

altered by Schellwien because of its previous adoption by Ulrich for another Foraminiferal organism, when he finally established the generic name of *Doliolina*\*, the fossil being now known as *Doliolina lepida*, which really forms the type of the genus. This organism is further understood to be characteristic of Permian rocks, being apparently known only from China and Japanese localities, although other examples of the genus have been recorded by Volz from the latest Carboniferous rocks of Sumatra†, but which subsequent investigators have recognised under other genera, such as Staff's *Verbeekina* and Yabe's *Neoschwagerina* (see Ozawa, Journ. Coll. Sci. Imp. Univ. Tokyo, 1925, vol. xlv. art. 6, pp. 48 and 54).

It may be assumed, therefore, that the presence of *Doliolina* in the Malay rocks would suggest that the latter may be satisfactorily regarded as belonging to a late Carboniferous or Permian age.

#### STROMATOPOROIDEA.

##### MYRIOPORA? (Pl. II. fig. 3 B.)

*Remarks.* One of the limestone sections contains among its other fossils a fragmentary semicircular organism which, from its contour and minute internal vermicular canal-like structure, accompanied by obscure evidence of pores, is rather suggestive of a Stromatoporoid body similar to *Myriopora*, a genus described by Volz‡ from the very latest Carboniferous rocks ("Oberes Obercarbon") of Sumatra. So far as can be seen, the structure also consists of numerous fine horizontal layers crossed by microscopically small and closely-arranged vertical tubes or canals. The Malay specimen can only be doubtfully determined at present, its more extended study from further sections being necessary to confirm the above statements as to its detailed structure, especially as the present section is somewhat obscure.

*Dimensions.* 5 × 2.5 mm.

Volz regarded *Myriopora* as more or less comparable with the Palæozoic *Stromatopora* as well as with the Mesozoic Milleporids, particularly citing the genera *Millestroma* of J. W. Gregory§ from the Cretaceous formation of

\* Schellwien, in Futterer's 'Durchsien,' 1903, vol. iii. part 1, p. 129 (footnote).

† Volz, Geol. Pal. Abhandl. (Koken), 1904, n. s., vol. vi. part 2, pp. 26, 27, or 110, 111.

‡ "Zur Geologie von Sumatra," Geol. Pal. Abhandl. (Koken), 1904, n. s., vol. vi. part 2, pp. 102-110, text-figures.

§ Geol. Mag. 1898, p. 337, pl. xiii.

Egypt and Steinmann's\* *Milleporidium* peculiar to the Stramberger limestone (=Tithon or Upper Portlandian) of the Austrian Alps. Volz† was also of opinion that *Stromatopora japonica*, established by Yabe‡ from the Mesozoic rocks (Upper Jurassic or Lower Cretaceous) of Japan, belongs in reality to *Myriopora*, an interesting fact in connection with both its geological and geographical distribution. Further, it should be mentioned that Yabe and Hayasaka§ have reported a doubtful form of *Myriopora* (*M. (?) pyriformis*) from the Upper Carboniferous of China. The true *Myriopora* is of abundant occurrence in Sumatran rocks of latest Carboniferous age, and I am inclined to think that the present Malay evidence, although obscure, is indicative of its occurrence in that country.

#### ANTHOZOA (CORALS).

##### *Chaetetes* sp. (Pl. II. fig. 3 A.)

*Remarks.* This section of a fragmentary composite coral may most probably be referred, in a general manner at any rate, to the *Chaetetes* of Fischer de Waldheim || originally described from the Carboniferous of Russia, and occurring particularly at Miatchkova, near Moscow, in association with *Fusulina cylindrica*. The present example appears to display a longitudinal section of a corallum possessing numerous fine tubes or corallites packed closely together which present a somewhat divergent or even a radial arrangement. The tubes show very doubtful evidence as to the presence of either pores or tabulae, probably from the fact that mineralization within consisting of a white calcitic impregnation has obliterated those more delicate structures.

*Dimensions.* 3 × 2 mm.

##### *Stenopora* sp. (Pl. III. figs. 6, 7.)

*Remarks.* Fragments of the Monticuliporoid genus *Stenopora*, originally described by Lonsdale¶ from the Permo-Carboniferous of Tasmania, appear to be fairly easily identifiable among the Malay fossils, where they are of frequent occurrence.

\* Beitr. Pal. Geol. Oesterreich-Ungarns Oriens, 1903, vol. xv. pp. 1-8, pls. i., ii.

† Centralblatt, 1913, no. 24, pp. 753-758, text-figures.

‡ Yabe, Journ. Geol. Soc. Tokyo, 1903, vol. x. no. 123, pp. 1-7, pl. xii.

§ "Palaeontology of Southern China," Reports Geographical Research in China from 1911-1916, p. 10, pl. vii. figs. 2b, 4, 5 (Tokyo, 1920).

¶ 'Oryctographie,' 1837, p. 159, pls. xxxv., xxxvi.

|| Appendix to Darwin's 'Volcanic Islands,' 1844, p. 161, and first figured in Strzelecki's Phys. Hist. New South Wales, 1845, pl. viii. p. 202.

The two examples now figured are represented by a longitudinal view of a fractured branch occurring in one of the microscopical limestone sections (Pl. III. fig. 6), while another (Pl. III. fig. 7) is a good natural limonite cast of a small branch displayed on the surface of one of the limestone slabs, in association with other fossils (*Fusulina* etc.).

These examples demonstrate the characteristic features of *Stenopora* as observed in the more ramose forms of the genus, although differing from those of massive growth like *Stenopora crinita*. The corallum is interiorly composed of small, contiguous, tubular corallites with lateral divergence from a pseudocentral axis, the more central tubes exhibiting a vertical arrangement (see Pl. III. fig. 6). Very obscure indications appear to be present of those minute annulations which are sometimes seen on the outer ends of the tubes.

One of the Malay examples (Pl. III. fig. 7) is extremely like a specimen described and figured by Geinitz as *Calamopora mackrothii*\* from the German Permian (Zechstein), which that author afterwards recognised as a *Stenopora*†; strong resemblances, also, exist with W. King's‡ illustration of the Geinitzian species which was identified among the Permian fossils of England. Without attempting a specific determination of the present specimens, it may be stated that the occurrence of *Stenopora* in the Malay fauna is of great interest, since it is quite characteristic of the latest Carboniferous or Permian epoch, its distribution extending through British and European countries to Eastern regions, Australasia, &c.

Although often regarded now as belonging to the Cyclostomatus Polyzoa, *Stenopora* is here retained among the Cœlenterate Corals as suggested by Nicholson§.

*Dimensions.* 11 × 2 and 9 × 3 mm.

#### CYATHOPHYLLOID CORAL. (Pl. III. fig. 2 B.)

*Remarks.* The specimen here figured appears to represent the remains of a simple Cyathophylloid Coral. It occurs as a lateral impression or cast on the limonised surface of one of the slabs of limestone, exhibiting a fairly wide corallum which through fossilization has been denuded of any epithecal covering that might have been originally present, and, therefore, disclosing numerous longitudinal septa which

\* Geinitz, 'Grundriss,' 1846, p. 582.

† Geinitz, 'Die Versteinerungen deutsch. Zechstein,' 1848, p. 17, pl. vii. fig. 10.

‡ King, Mon. Pal. Soc. 1860, p. 26, pl. iii. fig. 5.

§ "On the Structure and Affinities of the Genus *Monticulopora*," 1861, p. 62.



are specially well defined at the marginal summit of the fossil. Crossing the longitudinal costæ are a few distant ridges which possibly represent growth-gradations. This fossil might well belong to a genus like *Zaphrentis* or, in fact, to any of the other Palæozoic genera sharing Cyathophylloid characters.

Dr. Stanley Smith agrees with the writer in thinking that no closer determination of the Malay specimen can be attempted.

*Dimensions.* Height 25 mm., width 25 mm.

## CRINOIDEA.

### CYATHOCRINUS (?). (Pl. II. fig. 1 B.)

*Remarks.* Of common occurrence on the limonised surface of this rock are the small, circular, disc-like bodies, which may be recognised as stem-segments or the internodes of a Crinoidal organism. The articulating floors show a rounded periphery, and evidences of a central canal, whilst the radial striations are more or less obscure on account of mineralization. They may be compared with Schlotheim's *Encrinites ramosus* from the German Permian, as understood by King \* in his determination of material from similarly aged rocks of England, and which he regarded as referable to the genus *Cyathocrinus*, which is known alike in Carboniferous and Permian rocks.

*Dimensions.* Maximum diameter 5 or 6 mm.

## POLYZOA.

### *Fenestella* cf. *retiformis* (Schlotheim). (Pl. II. fig. 1 A ; Pl. III. figs. 3-5.)

*Keratophytes retiformis*, Schlotheim, Denksch. Akad. Wiss. München, 1820, vol. vi. Abhandl. pp. 17-20, pl. i. figs. 1, 2.

*Gorgia infundibuliformis*, Goldfuss, Petrefacta Germaniæ, 1827, vol. i. p. 20, pl. x. fig. 1.

*Fenestella retiformis*, Geinitz, Verstein. deutsch. Zechstein, 1848, p. 17, pl. vii. figs. 11-13; King, Permian Foss. England, Mon. Pal. Soc. 1850, pp. 35-38, pl. ii. figs. 8-19.

*Remarks.* Among the Malay fossils are many fragments of the genus *Fenestella*, occurring as natural casts on the limonised surfaces of the matrix. They are probably recognisable as one species with relationships to Schlotheim's *F. retiformis* originally described from the Permian (= Zechstein) formation of Germany. Our examples, so far as their preservation admits of an opinion, may be said to resemble

\* Mon. Pal. Soc. 1850, pp. 50-52, pl. vi. fig. 21.

very closely King's interpretation of the Schlotheim species as occurring in British Permian rocks. Further, some resemblances also exist with Fischer de Waldheim's *Retepora veneris* as understood by Trautschold\* from the Upper Carboniferous of Russia (Mjatschkowa). The Malay specimens possess an infundibuliform zoarium furnished with divergently arranged longitudinal rows of narrow grooves that represent the original stems or ribs of the organism. Spaced between these stems or grooves the numerous regularly situated and more or less ovaly-shaped fenestrules which are so typical of the structure of this genus. These fenestrules, on account of their cast-state of preservation, are well elevated above the lateral grooves, being likewise divided from each other by short, transverse, and obscurely seen ridges. The absence of any cellule-structure in our specimens would suggest, perhaps, that the basal regions are exposed, whereas the upper surfaces only (according to King) contain the cellules and their minute apertures in normally preserved specimens. The true *F. retiformis* appears to be restricted to the Permian formation of England and Germany, whereas some closely allied forms of *Fenestella* have long been known from the Permo-Carboniferous rocks of Australia †.

*Dimensions.* 30 × 13 mm.

#### PELECYPODA.

##### *Schizodus* sp. (Pl. III. fig. 2 A.)

*Remarks.* The fossil referred to this genus consists of a natural limonized cast of a Pelecypod valve occurring on the surface of the matrix, and in association with the Cyathophylloid coral previously mentioned. It represents an external face of a right valve denuded of all structure, having a rounded anterior margin, besides an excavated inner posterior margin succeeded by a truncated areal region. *Schizodus* valves have been figured by King ‡ from the British Permian formation, which somewhat resemble the Malay specimen. So far as the present impression is concerned, the evidence appears to be in favour of recognising it as belonging to King's genus *Schizodus*, which is a well-known characteristic shell of Permian times.

*Dimensions.* Length 18 mm., height 15 mm.

\* Mém. Soc. Imp. Nat. Moscou, 1876, vol. xiii. p. 365, pl. x. figs. 12, 13.

† Jack and Etheridge, Junr., 'Geology and Palæontology of Queensland,' 1892, pp. 217-218, pl. ix.

‡ Mon. Pal. Soc. (London), 1850, pp. 185-193, pl. xv.

*Pleurophorus* sp. (Pl. III. fig. 1.)

*Remarks.* Among the fragmentary and doubtful Pelecypod remains, the genus *Pleurophorus* as first defined by King\* appears to be represented in the Malay limestone fauna. The specimen herewith figured, a natural limonised cast, exhibits the lateral surface of an elongately narrow, inequilateral left valve, on which is observed a continuous pallial line nearly parallel with the ventral margin, slight evidence existing of the anterior cavity beneath the umbonal region which would indicate the position of an adductor scarring. The umbonal region is very anteriorly situated, whilst the dorsal and ventral margins are more or less parallel to each other. The presence of this genus is important stratigraphically, being characteristic of Permian rocks. A second and smaller cast of the same shell is associated in the plate illustration.

*Dimensions.* Length 17 mm., height 8 mm.

**Previous Work on Malayan and Siamese Fossils from  
Carboniferous and Permian Rocks.**

Having described in this paper the elements of a fauna from a quartzitic rock occurring near the Malay-Siamese frontier, which prove to be of late Carboniferous or Permian age, or what may be regarded as Ouralian-Permian, which is synonymous with that frequently referred to in literature as Permo-Carboniferous, a denomination which would, also, include such rock-groups as Waagen's *Anthracolitic* (pars), Mayer-Eymar's *Stephanian*, and the Marine portion of the *Pennsylvanian*† period of the United States—these horizontal terms having been regarded as of more or less equivalent value in geological chronology,—it will be interesting to briefly mention some further Carboniferous and Permian fossils from other parts of the Malay States that have been referred to in the published literature on the subject.

The first account of such material was made by Mr. Scrivenor‡, who mentioned the discovery of some limestone fossils at Mill Gully and Goa at Ulu Pahang, in an area formerly known as the Ponjom Concession. These fossils comprised rather obscure remains of Corals, Crinoids, &c., besides some Cephalopoda which the late G. C. Crick

\* Mon. Pal. Soc. (London), 1850, p. 180 (Monograph of the Permian Fossils of England), compare pl. xv. fig. 15.

† Chamberlin and Salisbury, 'Geology,' 1906, vol. ii. pp. 587, 618.

‡ 'Geologist's Report for 1904, F.M.S.,' published 1906, pp. 1, 2.

recognised as *Orthoceras*, *Cyrtoceras*, *Gyroceras*, and *Solenocheilus*, an assemblage of genera which indicated a Carboniferous horizon. At a later date the present writer \* regarded this limestone fauna as about equivalent in age to that characteristic of the Viséan deposits of Europe (Belgium &c.), a suggestion which was afterwards confirmed by Dr. Stanley Smith †, who had studied the same corals as were found in the Mill Gully and Goa limestones (=Kuantan District of Pahang as in Scrivenor's Report), and had determined them as follows:—*Caninia* cf. *gigantea*, Michelin, *Cyathaxonia* sp., Clisiophyllid coral, and *Dibunophyllum* sp. The "Viséan" horizon of Europe includes the oldest deposits of the Carboniferous, which, according to De Lapparent ‡, are comprised in the Dinantian or Culm stage of that system of rocks.

Further limestone fossils, but quite unrecognisable, were collected by the late Mr. H. M. Becher at Gua Sai (or Gua Sah), Pahang, a notice of which was published by the writer in the 'Geological Magazine' for 1891, pp. 189, 190. They consisted of indeterminable Crinoidal remains and other doubtful organisms, although considered of insufficient importance at the time for determining their geological age. Since then, however, it is thought that the Gua Sah beds form part of the Mill Gully and Goa deposits which have now been recognised as belonging to the Viséan division of the Carboniferous. Certain imperfect natural casts and impressions of fossils have been discovered at Lubok Sukum, between Kuala Kechau and Kuala Chika, in the Province of Pahang, one of which was determined as an Ammonoid resembling *Xenodiscus* by the late G. C. Crick §, besides a straight tube-like organism which, according to the present writer, was probably allied to *Dentalium* (*Entalis*) *herculea*, Koninck. It was pointed out at the time that the association of these two fossils in the Malay beds corresponded with a similar occurrence in the Upper *Productus* Limestone of the Salt Range, India ||, and, as such deposits were regarded as Permian, it was conjectured

\* Newton, R. B., Quart. Journ. Geol. Soc. 1913, vol. lxi. p. 370 (=discussion on J. B. Scrivenor's memoir on "The Geological History of the Malay Peninsula").

† Scrivenor, J. B., 'Geologist's Ann. Rept. F.M.S. for 1910,' issued 1920, p. 4.

‡ 'Traité de Géologie,' 1906, ed. 5, p. 975.

§ R. B. Newton and G. C. Crick, in Scrivenor's 'Geologist's Rept. Progress F.M.S.,' September 1903-January 1907, published 1907, p. 4.

|| Waagen, Pal. Indica, Mem. Geol. Surv. India, 1887, ser. xiii. vol. i. pp. 32, 180, 181.

that the same geological age might be suggested for the Malay fossils.

In much more recent years Messrs. J. B. Scrivenor and E. S. Willbourn \* have reported some Carboniferous fossils from the Langkawi Islands, situated off the north-west corner of Malaya (Perlis region), consisting of badly preserved, indeterminable Gastropoda, Polyzoa, and Crinoidal stems. With more promising material, however, for examination in the future, it may be possible to accurately state whether these fossiliferous remains belong to the lower or upper stages of the Carboniferous series, although, in the meantime, considering the closeness of that region to the Perlis calcareous quartzites, it is very likely they may belong to rocks of the same geological age, viz., Ouralian-Permian.

As very similar geological conditions prevail in the Kingdom of Siam, a brief reference will be made to the Carboniferous faunas known to occur in that country. Among the writers upon this subject may be mentioned Dr. Bertil Högbom †, who has reported the presence of Brachiopoda (not identified) and Fusulinas in southern Siamese rocks, the geological age of which is given as "Upper Carbonian and Perm (Ouralian)"—this author often using the term "Permo-Carbonian" to express his views as to the age of these particular deposits, which he recognises as bearing relationships to corresponding beds of neighbouring countries, such as occur in Burma (Tenasserim ‡), Sumatra, &c.

In a paper read by Dr. Cowper Reed before the Geological Society of London in 1916, on some "Carboniferous Fossils from Siam" (Patalung district), I § took occasion to refer in the discussion to a small collection of Lower Carboniferous fossils from Siam, obtained from about 200 miles N. of Bangkok by the late W. M. Daly, which were presented to the Geological Department of the British Museum in 1900, through the late Dr. W. T. Blanford. These specimens embraced the genera *Schizostoma*, *Yvania*, *Murchisonia*, *Nucula*, *Dielsma*, Crinoidal stem-fragments,

\* "The Geology of the Langkawi Islands, with a Geological Sketch-map," Journ. Malayan Branch Roy. Asiatic Soc. 1923, no. 88, p. 4.

† Bull. Geol. Inst. Univ. Upsala, 1913, vol. xii, p. 106.

‡ Noetling, "Carboniferous Fossils from Tenasserim (Burma)," Records Geol. Surv. India, 1893, vol. xxvi, pp. 96-100, plate of fossils. (These Burma beds are included in the Moulmein Group, which Noetling regards as probably the upper part of the Carboniferous—they contain *Schwagerina*, Brachiopoda, Mollusca, &c.)

§ R. B. Newton, Abstracts Proc. Geol. Soc. London, 1916, no. 991, p. 62.

and *Valvulina*. They were considered as of older Carboniferous age, because of the absence of *Schwagerina*, *Fusulina*, and *Stenopora*, which would have indicated a much younger horizon of the Carboniferous period.

Dr. Reed's full paper on the Patalung fauna of Lower Siam was published in the 'Geological Magazine' for 1920. From the fact that that fauna presented a Culm facies, the author (Dr. Reed) determined it as belonging to the older part of the Carboniferous system. Curious to state, it had previously, although erroneously, been regarded as Cretaceous by W. W. Skeat\* and as Permo-Carboniferous by T. McKenny Hughes†.

#### Geological Summary.

In a final statement on the stratigraphical facts connected with the explanations offered of the organic structures from Malay and Siam, as mentioned or described in this paper, it seems to be clearly proved that in both countries there exist two phases of the Carboniferous system—the oldest represented by the so-called Viséan stage, whilst the youngest belongs to the Ouralian-Permian division. The probable true Permian facies is only known at present in Malaya from the occurrence there of *Nenodiscus* and a form allied to *Dentalium herculea* of Koninck. No older fossils than those mentioned in the paper have yet been recorded from either Malay or Siam.

For kindly services during the compilation of this paper, the writer desires to thank three of the Clerical Officers of the Geological Department, British Museum: Messrs. Broadbent and Rowbotham, for bibliographical and clerical assistance, and Mr. Spires, for the preparation of microscopical slides exhibiting the organisms delineated in the plates.

In conclusion, it should be mentioned that the material on which this paper is based is contained in the Geological Department of the British Museum, having been presented by Mr. Scrivenor.

#### EXPLANATION OF THE PLATES.

##### PLATE II.

##### *Fusulina* cf. *granum-avenæ*, Roemer.

Fig. 1 C. External views exposed on surface of limonised matrix. (Nat. size.)

Fig. 2. External view on matrix of a fragmentary test, showing the longitudinal grooves. ( $\times 4$ .)

\* Report Brit. Assoc. Bradford, 1900, pp. 393-398.

† *Ibid.* Glasgow, 1901, p. 414.

**Figs. 3 C, 4.** Longitudinal sections in matrix exhibiting internal structures. ( $\times 4$ .)

**Figs. 5, 5 A.** Transverse sections in matrix. ( $\times 4$ .)

**Fig. 6.** Enlarged view of 5 A, showing the white calcitic impregnations of the chambers. ( $\times 16$ .)

*Doliolina cf. lepida*, Schwager.

**Figs. 7, 7 A.** Sections in matrix, the chief being a longitudinal view (A) showing closely arranged rectangular chambers separated by regular transverse mural divisions. The darker objects in the section are supposed to belong to the same organism. ( $\times 4$ .)

*Chaetetes* sp.

**Fig. 3 A.** Section of a fragmentary corallum in matrix, showing minute divergent corallites. ( $\times 4$ .)

*Myriopora* (?).

**Fig. 3 B.** Portion of a semicircular organism with obscure minute vermicular structure suggestive of Stromatoporoid origin. ( $\times 4$ .)

*Fenestella cf. retiformis* (Schlotheim).

**Fig. 1 A.** Portion of a zoarium as a limonised natural cast. (Nat. size.)

*Cyathocrinus* (?).

**Fig. 1 B.** Stem-segments of a Crinoid showing articulating surfaces probably referable to this genus. (Nat. size.)

PLATE III.

*Pleurophorus* sp.

**Fig. 1.** Natural limonised casts of two valves of this genus on a surface of matrix. (Nat. size.)

*Schizodus* sp.

**Fig. 2 A.** Natural limonised cast, showing an external face of a right valve associated with a Cyathophylloid coral. (Nat. size.)

*Cyathophylloid Coral.*

**Fig. 2 B.** Externo-lateral aspect of a limonised impression belonging to a Cyathophylloid coral, presenting a longitudinal view of the septa, which are best defined at the margin of the cup. (Nat. size.)

*Fenestella cf. retiformis* (Schlotheim).

**Figs. 3, 5.** Limonised casts on the surface of the matrix, exhibiting the elevated fenestrules bordered by divergent grooves which represent the longitudinal stems of the zoarium. (Nat. size.)

**Fig. 4.** Wax-impression taken from specimen delineated in fig. 3, giving a clearer conception of structural details. (Nat. size.)

*Stenopora* sp.

**Fig. 6.** Longitudinal section in matrix of a fractured branch displaying its minute internal corallites with lateral divergence, although vertically arranged in the centre. ( $\times 4$ .)

**Fig. 7.** A limonised natural cast of a branch exhibiting the corallite structure. ( $\times 4$ .)

VIII.—*New or little-known Tipulidæ (Diptera).—XXX. Australasian Species.* By CHARLES P. ALEXANDER, Ph.D., F.E.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.

THE species described at this time are all from New Zealand, where they were collected by my friends Messrs. Campbell, Fenwick, Harris, Howes, Stuart Lindsay, Myers, Philpott, Tillyard, and Tonnoir. I am especially indebted at this time to Dr. Tonnoir, who personally collected the majority of the species herein described as new. The types of the novelties collected by Tonnoir have been returned to him for redistribution in New Zealand collections. The other types are preserved in the collection of the writer.

*Polymoria proximata*, sp. n.

Allied to *P. argus* (Hutton); wings nearly hyaline with ocelliform yellow markings that are narrowly margined and centred with brown;  $R_{2+3}$  longer than the basal section of  $R_2$ ; *m-cu* at the proximal end of cell 1st  $M_2$ .

*Male*.—Length about 14 mm.; wing 11.5 mm.

Rostrum and palpi brown. Antennæ with the scapal segment buffy, strongly tinged with green; flagellum broken. Head greenish brown, heavily pollinose.

Pronotum yellowish fulvous. Mesonotal præscutum yellowish pollinose, the usual stripes more infuscated, better indicated behind; scutum yellowish pollinose, each lobe with a brown mark; scutellum brownish yellow; postnotal mediotergite yellow, extensively infuscated medially. Pleura greenish yellow, variegated with brown on the anepisternum, sternopleurite, and postnotal pleurotergite; dorso-pleural membrane more fulvous. Halteres pale, the extreme bases indistinctly greenish, the knobs passing into clearer yellow. Legs with the coxæ and trochanters pale, strongly suffused with greenish; femora greenish yellow with two narrow brown rings before the tips; tibiæ greenish brown, the tips a little darker; tarsi brown. Wings yellow and subhyaline, the costal region and a broad seam along vein *Cu* more yellowish, the disc whitish subhyaline; a conspicuous pattern of brown ocelliform markings, marginal and along the cord, outer end of cell 1st  $M_2$ , fork of  $M_{1+2}$ , and in the radial cell; ocelliform markings yellow with very narrow brown centres; marginal spots smallest at vein  $M_3$ , becoming larger and with more conspicuous



centres to vein 2nd *A*; veins greenish. Venation: *Sc*<sub>2</sub> at tip of *Sc*<sub>1</sub>, extending to beyond mid-length of *R*<sub>2+3</sub>; *Rs* relatively short, arcuated at origin; *R*<sub>2+3</sub> long, exceeding the basal section of vein *R*<sub>2</sub>; cell *M*<sub>1</sub> about twice its petiole; *m-cu* at the proximal end of cell 1st *M*<sub>2</sub>.

Abdomen greenish pollinose, without distinct darker markings. Male hypopygium generally similar to that of *P. argus*, the interbasal process longer and narrower.

*Hab.* New Zealand (North Island).

*Holotype*, ♂, Auckland, Auckland, February 3, 1924 (*T. R. Harris*)

*Limnophila tonnoiri*, sp. n.

Allied to *L. nebulifera* (Alexander); wings pale brown with a relatively small darker brown cloud at origin of *Rs* and a conspicuous seam along the cord; male hypopygium with the outer dististyle weakly toothed at apex.

*Male*.—Length about 4.5 mm.; wing 5.3 mm.

Rostrum and palpi brown. Antennæ short, brown throughout; flagellar segments oval, the ends truncated; verticils longer than the segments. Head dark brown, discoloured in the unique type.

Mesonotum uniformly dark brown, the pseudosutural foveæ conspicuous, brownish black; postnotum testaceous brown. Pleura brownish testaceous. Halteres relatively elongate, pale brown. Legs with the coxæ and trochanters pale; remainder of legs pale brown throughout; tibial spurs long and straight, a little more than the basal half conspicuously setiferous, the apex glabrous; claws relatively small, each with a small basal tooth. Wings pale brown with a diffuse darker brown pattern, the oval stigma a trifle darker-coloured than the remaining clouds; these markings include seams at origin of *Rs*; tip of *Sc*<sub>1</sub>; along cord and outer end of cell 1st *M*<sub>2</sub>; veins darker brown. Macrotrichia on the longitudinal veins beyond the cord, including about five on the distal third of *Rs*; cross-veins and deflections of veins without trichia. Venation: *Sc*<sub>1</sub> ending a short distance before the tip of *Rs*, *Sc*<sub>2</sub> about twice its length from the tip of *Sc*<sub>1</sub>; *Rs* long, nearly straight; *r* very faint, a little more than its own length from the tip of *R*<sub>1</sub>; inner ends of cells *R*<sub>3</sub>, *R*<sub>5</sub>, and 1st *M*<sub>2</sub> in transverse alignment; *R*<sub>2+3</sub> about equal to or a little longer than *m-cu*; cell *M*<sub>1</sub> shorter than its petiole; cell 1st *M*<sub>2</sub> relatively small; *m-cu* just beyond the fork of *M*; anterior arculus present.

Abdomen brown, including the hypopygium. Male

hypopygium with the basistyles relatively slender, slightly narrowed distally; mesal face at base with the interbasal process a flattened, obtusely truncated, blackened collar-like plate that partially encircles the base of the style; surface of basistyle with long setæ, shorter and more numerous on the pale mesal face; apex of basistyle produced caudad and slightly mesad into a small cylindrical lobe that is a little shorter and more slender than the fleshy dististyle, the apex rather suddenly narrowed, short-setiferous, the base of this lobe glabrous or with still shorter setæ. Dististyles two, the outer style a slender black rod, feebly dilated just before the tip, which is short, acute, gently decurved, just before the apex on outer margin with two small obtuse denticles to produce a weakly toothed effect; inner or fleshy dististyle a little more than one-half the length of the outer style, pale, long-setiferous. Gonapophyses appearing as flattened blades, the apex of each produced mesad as a long, acute, blackened spine.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Nelson, Nelson, September 28, 1923 (*A. Tonnoir*).

*Paratype*, ♂, Aniseed Valley, Nelson, December 1-4, 1923 (*A. Tonnoir*).

This interesting crane-fly is named in honour of Dr. André L. Tonnoir, to whom I am indebted for many favours.

*Limnophila perscita*, sp. n.

General coloration light brown; head yellowish grey; femora obscure yellow; wings with a strong yellow tinge, the stigma, a spot at origin of *Rs*, seams along the cord and outer end of cell 1st *M*<sub>2</sub>, and a spot at fork of *M*<sub>1+2</sub> dark brown.

*Female*.—Length 6·8·3 mm.; wing 7·2·8·2 mm.

Rostrum and palpi dark brown. Antennæ brown throughout; flagellar segments oval, with verticils of moderate length. Head dark yellowish grey; vertex between the eyes of moderate width.

Mesonotum light brown, in cases with four darker stripes that are better defined posteriorly; in front with a single median stripe that becomes obsolete near the tuberculate pits; scutal lobes slightly darkened; remainder of mesonotum reddish brown. Pleura brownish yellow, the anepisternum more or less infuscated and weakly pruinose. Halteres yellow. Legs with the coxæ and trochanters brownish yellow; femora obscure yellow with relatively

conspicuous setæ; remainder of legs testaceous yellow, the terminal tarsal segments dark brown. Wings with a strong yellowish tinge, the base and cells *C* and *Sc* a trifle more saturated; subhyaline longitudinal streaks in cells *R* and 1st *M*<sub>2</sub> along vein *M* and in bases of the anal cells; conspicuous dark brown markings as follows: at origin of *Rs*; the elongate-oval stigma; conspicuous seams along cord and outer end of cell 1st *M*<sub>2</sub>, the latter cell so small that the marks are nearly confluent; a spot at fork of *M*<sub>1+2</sub>; a more or less distinct spot at arculus; veins yellow, darker in the infuscated areas. Venation: *Sc*<sub>1</sub> ending about opposite the fork of *Rs*, *Sc*<sub>1</sub> about equal to *m-cu*; *Rs* moderately arcuated; *r* at about one-third the length of the stigma and just beyond mid-length of the terminal section of *R*<sub>1</sub>; inner ends of cells *R*<sub>3</sub>, *R*<sub>4</sub>, and 1st *M*<sub>2</sub> in oblique alignment; cell 1st *M*<sub>2</sub> very small; cell *M*<sub>1</sub> shorter than its petiole; *m-cu* near mid-length of the lower face of cell 1st *M*<sub>2</sub>; anterior arculus preserved.

Abdomen obscure brownish yellow, the sternites a little clearer yellow. Ovipositor with the tergal valves long and slender, gently upcurved. In some cases, the abdominal segments are light brown, indistinctly ringed caudally with paler.

*Hab.* New Zealand (South Island).

*Holotype*, ♀, Dun Mt., Nelson, March 1, 1924 (*A. Philpott*); collector's number 60.

*Paratypes*, 2 ♀ ♀, Waiho, Westland, altitude 600 feet, January 28, 1922 (*A. Tonnoir*).

It is very possible that the discovery of the male sex of this conspicuous fly will result in its removal to the genus *Zelandomyia*. It is retained in *Limnophila* only in the broadest usage of the name.

### *Limnophila spissigrada*, sp. n.

Subapterous (at least in ♀ sex); wings about as long as the combined head and thorax; general coloration brown, grey pruinose; posterior sclerites of mesonotum flattened; femora dilated distally, the segments of the legs hairy.

*Female*.—Length about 3.2–3.5 mm.; wing 1.5 mm.

Rostrum and palpi dark brown. Antennæ short, if bent backward extending about to the wing-root; black throughout; flagellar segments oval with verticils that are slightly longer than the segments. Head grey, the vertex more yellowish, the narrowest portion passing into silvery.

Mesonotum brown, grey pruinose; posterior sclerites

much depressed, the scutum, scutellum, and postnotal mediotergite being almost plane. Pleura grey. Halteres pale, including the knobs. Legs large and conspicuous, the segments with conspicuous erect setæ; trochanters dark, sparsely pruinose, the tips more yellowish; femora incrassated outwardly, brown, the bases narrowly paler; tibiæ pale brown, the tips narrowly darker; tarsi brownish black. Wings semi-atrophied, about as long as the combined head and thorax, the venation not seriously distorted; coloration brownish white, more yellowish before the cord; veins dark brown, conspicuous. Conspicuous macrotrichiæ on vein *R* back to arculus; on *R*<sub>3</sub>, *R*<sub>4+5</sub>, *M*<sub>1+2</sub>, *M*<sub>1</sub>, *M*<sub>2</sub>, distal section of *M*<sub>3</sub>, *M*<sub>4</sub> beyond *m-cu*; solitary bristles at outer ends of veins *Cu*<sub>1</sub> and 2nd *A*. Prearcular region extensive, the arculus lying near one-fourth the wing-length. Venation: almost as in a typical *Limnophila*; *Rs* relatively long, almost square at origin; *R*<sub>2+3</sub> short, approximately equal to the basal deflection of *R*<sub>4+5</sub>; cell *M*<sub>1</sub> shorter than its petiole; *m-cu* less than its length beyond the fork of *M*; anterior arculus present.

Abdomen dark brown, the tergites more or less pruinose; subterminal sternite obscure yellow at base; base of sternal valves of ovipositor blackened. Ovipositor with the tergal valves relatively short, strongly upcurved, the tips acute, brownish yellow to horn-coloured.

*Hab.* New Zealand (South Island).

*Holotype*, ♀, Mt. Arthur Tableland, Nelson, altitude 5000 feet, December 23, 1921 (*A. Tonnoir*); collector's number 120.

*Paratopotypes*, 2 ♀♀, altitude 4500 feet, December 27, 1921 (*A. Tonnoir*).

The strict generic position of this little alpine fly is somewhat in question. The species seems to be related to *L. oliveri*, Alexander, but certain features, especially the structure of the ovipositor, would indicate that it might well be a *Metalimnophila*.

*Metalimnophila protea*, sp. n.

General coloration light greyish brown, the thoracic pleura with a narrow brown longitudinal stripe; male hypopygium of simple structure; basistyle scarcely produced at tip; dististyles two, simple; armature of genital chamber reduced to three powerful curved hooks on either side.

*Male*.—Length about 6.2 mm.; wing 6.8 mm.

Rostrum and palpi black. Antennæ of moderate length, if bent backwards extending to near mid-length of the abdomen, black throughout; flagellar segments elongate-cylindrical. Head dark grey.

Mesonotal præscutum light greyish brown, the stripes somewhat darker-coloured; scutellum and postnotum light grey. Pleura pale, light grey pruinose, with a narrow brown longitudinal dorsal stripe extending from above the fore coxæ to the postnotal pleurotergite. Halteres pale, the knobs a little darker. Legs with the coxæ and trochanters obscure brownish yellow; femora obscure brownish yellow, the tips very slightly darkened; tibiæ concolorous, the tips narrowly darkened; tarsi pale brown; the terminal segments passing into darker. Wings with a faint brown tinge, the oval stigma darker brown; veins dark brown. Venation:  $Sc_2$  at the tip of  $Sc_1$ , the latter ending immediately before the fork of  $R_s$ ;  $R_s$  weakly angulated at origin, in alignment with  $R_{2+3}$  which is subequal to the basal deflection of  $R_{4+5}$ ;  $r$  very faint, about twice its length beyond the fork of  $R_{2+3}$  and near two and one-half times its length from the tip of  $R_1$ ; cell 1st  $M_2$  relatively long and narrow; petiole of cell  $M_1$  about one-half longer than the cell;  $m-cu$  a little less than its own length beyond the fork of  $M$ .

Abdomen dark brown, the hypopygium paler. Male hypopygium of a very primitive structure for a member of this genus. Basistyles very short and stout, the outer face with long coarse macrotrichia; the usual produced lobe on mesal face at apex reduced to a low rounded protuberance. Dististyles two, but connected with one another at base by membrane; outer dististyle longer, appearing as a broad-based gently curved appendage that gradually narrows to the acute blackened apex; inner dististyle slender, cylindrical, gradually narrowed to the obtusely rounded apex which terminates in a single large seta. The usual spinous armature of the genital chamber is here reduced to three large curved black hooks on either side.

*Hab.* New Zealand (Both Islands).

*Holotype*, ♂, Mt. Ruapehu, Wellington, altitude 3000–4000 feet, January 20, 1924 (*T. R. Harris*).

*Paratype*, ♂, Maitai Valley, Nelson, March 16, 1922 (*A. Tonnoir*).

"Along trail through beech (*Nothofagus*) forests."—*Harris*.

*Metalimnophila protea* superficially resembles *M. howesi*

(Alexander), differing conspicuously from all described species in the structure of the male hypopygium.

*Metalimnophila greyana*, sp. n.

Antennæ of male a little shorter than the body; male hypopygium with the apex of each basistyle produced into a short obtuse lobe and a small blackened conical tubercle; outer dististyle narrowed to the apex, which is conspicuously bifid and restrictedly blackened.

*Male*.—Length about 6.2 mm.; wing 6.6 mm.

Rostrum and palpi black. Antennæ elongate, only a little shorter than the body; flagellar segments cylindrical to slightly fusiform; scape brown, flagellar segments black, the extreme base of the proximal segments paler. Head dark grey.

Mesonotum brown, the præscutum with four ill-defined slightly darker brown stripes, the intermediate pair only narrowly separated; scutellum and postnotum sparsely pruinose. Pleura dark brown dorsally, more pruinose ventrally; ventral half of sterno-pleurite suddenly paler; meron ochreous. Halteres pale, the knobs darker. Legs with the coxæ and trochanters light yellow; remainder of legs broken. Wings with a pale brown tinge, cells *C* and *Sc* slightly more yellowish; stigma darker brown; veins dark brown. Venation: *Sc*<sub>1</sub> ending just before the fork of *Rs*, *Sc*<sub>2</sub> at its tip; *Rs* unevenly arcuated; *R*<sub>2+3</sub> and basal deflection of *R*<sub>4+5</sub> approximately equal; *R*<sub>2</sub> uneven; cell *M*<sub>1</sub> about as long as its petiole; cell 1st *M*<sub>2</sub> small, gently widened distally; *m-cu* at near one-third the length of cell 1st *M*<sub>2</sub>.

Abdomen dark brown. Male hypopygium with the basistyles stout, the mesal apical angle only slightly produced, the opposite mesal angle with a small, blackened, somewhat conical tubercle that is weakly trifid. Outer dististyle a gently arcuated, elongate-conical horn, gradually narrowed to the apex, pale, the surface with abundant setæ, the apex narrowly blackened, terminating in two conspicuous black spines; inner dististyle small and slender, narrowest just before the bluntly rounded apex. Genital armature relatively powerful, there being about six blackened spines on either side.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Grey, Canterbury, in beech forest, February 23, 1924 (*J. W. Campbell*).

*Metalimnophila yorkensis*, sp. n.

*Male*.—Length about 5.3 mm.; wing 6 mm.

Closely related to the genotype, *M. mirifica* (Alexander), differing chiefly in antennal and genitalic characters.

Antennæ considerably shorter, if bent backward not extending to beyond mid-length of the abdomen, the flagellar segments correspondingly shorter. Mesonotal præscutum with three darker brown stripes. Legs with the coxæ obscure yellow. Wings with the veins dark brown. Macrotrichia on all the longitudinal veins for virtually their entire lengths; sparse trichia on many of the cross-veins and deflections of veins. Venation:  $Sc_2$  longer than  $Sc_1$ ;  $r$  near one-third the length of the stigma, more than twice its length beyond the fork of  $R_{2+3}$ ; cell  $M_1$  about two-thirds its petiole;  $m-cu$  near mid-length of the lower face of cell 1st  $M_2$ . Male hypopygium with the apex of each basistyle produced caudad and slightly mesad into a slender rod that is only a little shorter than the inner dististyle; the rod is gently curved toward the tip which terminates in a single, small, conical spine; entire apex of the rod densely set with short recurved setæ; near mid-length on outer edge of stem are two or three very long and powerful setæ. Outer dististyle fleshy and provided with long setæ on basal three-fourths, the outer setæ larger and more conspicuous; apex of style somewhat narrowed into a flattened, obtuse, darkened blade that is provided with tiny setigerous punctures. Inner dististyle fleshy, the lateral apical angle prolonged into a slender digitiform lobe that terminates in a single strong seta; mesal apical angle of style tumid, provided with several short stout setæ. Armature of genital chamber powerful. Ninth tergite with two slender, gently divergent rods, separated by a deep V-shaped notch.

*Hub.* New Zealand (North Island).

*Holotype*, ♂, York Bay, Wellington, February 2, 1924 (J. G. Myers).

*Paratypes*, 2 ♂ ♂, Nihotapu, Auckland, altitude 500 feet, February 23–25, 1923 (A. Tonnoir).

*Metalimnophila productella*, nom. nov.

1922. *Limnophila* (*Metalimnophila*) *producta*, Alex., Ann. & Mag. Nat. Hist. (9) ix. pp. 514–515; nec *Prionolabis producta*, Meun., Mon. Tipulidæ et Dixidæ de l'Ambre de la Baltique, pp. 376–377 (1906).

An examination of the type-specimen of Meunier's *Prionolabis producta* (Baltic amber) shows that it is referable to the genus *Limnophila*, necessitating the above change of name.

*Zelandomyia tantula*, sp. n.

*Male*.—Length about 3 mm. ; wing 3.5 mm.

*Female*.—Length 3.6 mm. ; wing 3.8 mm.

Closely allied to *Z. pygmæa*, Alexander, differing as follows :—

General coloration slightly darker, including the head which is faintly pruinose. Wings with  $R_{2+3}$  shorter, approximately one-half, or a trifle more, of  $R_2$  alone ; cell 1st  $M_2$  closed by the retention of  $m$ , relatively large for a member of this genus. Male hypopygium with the gonapophyses strongly curved, the extreme tips bent mesad into long, slender, very acute tips. In *Z. pygmæa*, the gonapophyses are broad-based, the tips short and very obtuse.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Rewanui, Paparoa Range, Westland, altitude 600–800 feet, February 15, 1923 (*T. R. Harris*).

*Allotopotype*, ♀.

*Tricyphona furcata*, sp. n.

*Male*.—Length about 7 mm. ; wing 10–10.5 mm.

*Female*.—Length about 8.5 mm. ; wing 11 mm.

Related to *T. novæ-zelandiæ*, Alexander, differing chiefly in the structure of the male hypopygium, especially the deeply furcate interbasal process.

Antennæ dark brown throughout ; flagellar segments short-oval, clothed with a delicate white pubescence. Head with the centre of the vertex largely brown. Median pre-scutal stripe narrowly split by a capillary dull grey vitta. Pleura strongly grey pruinose. Wings more greyish. Venation : cell  $R_2$  normally sessile, in one wing of the paratype male short-petiolate ;  $m$  nearly its length beyond the fork of  $M_{1+2}$  ; in the allotype, cell 1st  $M_2$  is open by the atrophy of  $m$  in both wings. Male hypopygium obscure brownish yellow ; mesal face of basistyle with a group of long powerful setæ ; dististyle very extensive, especially the yellowish chitinized portion which is deeply notched on external margin, the surface with abundant microscopic delicate setæ and a few large powerful bristles. Interbasal process appearing deeply forked, the organ being bent into the shape of a boomerang, the apex obtusely rounded, just beyond the bend with a long, powerful, acute spine that is subappressed to the apex. Tergal region with caudal margin transverse, each lateral angle produced caudad into a conical setiferous lobe ; beneath each caudal-lateral angle



arises a hook-like chitinized rod that is likewise shaped somewhat like a boomerang, but smaller than the interbase, the apex obtuse.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Arthur Tableland, Nelson, altitude 4500 feet, December 26, 1921 (*A. Tonnoir*); collector's number 119.

*Allotopotype*, ♀, December 21, 1921.

*Paratopotype*, ♂, with the allotype.

*Rhabdomastix (Sacandaga) monilicornis*, sp. n.

*Female*.—Length 4·8 mm.; wing 4·8 mm.

Closely allied to *R. (S.) neozelandia*, Alexander, differing as follows:—

Antennæ short, the six basal flagellar segments moniliform, or nearly so, each being only a trifle longer than wide (terminal segments broken). In *neozelandia* the intermediate and outer flagellar segments are long, fully twice as long as broad. Head broad, heavily dusted with grey. Mesothorax dark brown, very sparsely dusted with a yellowish pollen, not at all pruinose. Knobs of the halteres infuscated. Wings with a strong brownish tinge, the stigma scarcely darker; veins darker brown. No macrotrichia on veins  $Rs$ ,  $R_{2+3}$ ,  $R_2$ ,  $R_3$ ,  $M_{1+2}$ ,  $M_3$ , or  $M_4$ ; those on  $R_{4+5}$  confined to the outer four-fifths of the vein and relatively scattered. Abdomen brownish black. Ovipositor with the tergal valves slender, strongly upcurved, near two-thirds the length becoming slightly expanded and pale.

*Hab.* New Zealand (South Island).

*Holotype*, ♀, Maitai Valley, Nelson, March 16, 1922 (*A. Tonnoir*); collector's number 105 n.

*Rhabdomastix monilicornis* is readily distinguished by the nearly moniliform antennæ, the total lack of macrotrichia on all veins beyond the cord excepting  $R_{4+5}$ , and the dark-knobbed halteres.

*Rhabdomastix (Sacandaga) trichiata brunneipennis*, subsp. n.

*Male*.—Length about 4 mm.; wing 5·5 mm.

*Female*.—Length about 4·5 mm.; wing 6·2–6·5 mm.

Differs from typical *trichiata*, Alexander, in the following regards:—

Head and thorax dark brown, without pruinosity, the mesonotum almost black, subshiny. Wings with a uniform strong brownish suffusion, the costal region and stigma only a trifle darker. Macrotrichia on  $R_{2+3}$  reduced to but two

or three scattered setæ. Venation:  $R_{2+3}$  elongate, from four to five times  $R_2$  alone;  $R_2$  short, the space on costa between  $R_1$  and  $R_2$  nearly twice the length of the latter vein alone.

The spines on the outer margin of the outer dististyle of the male hypopygium are relatively short and markedly appressed to the margin of the style; terminal spine relatively stout. The inner dististyle is rather suddenly narrowed at apex into a cylindrical tip that bears a single powerful seta. Distal blades of gonapophyses relatively narrow.

*Hab.* New Zealand (North Island).

*Holotype*, ♂, Nihotapu, Auckland, altitude 500 feet, February 24, 1923 (*A. Tonnoir*); collector's number 105 h.

*Allotopotype*, ♀.

*Paratopotypes*, 2 ♀ ♀.

*Gonomyia (Lipophleps) ludibunda*, sp. n.

Generally similar to *G. (L.) nigrohalterata*, Edwards; abdomen largely orange; outer dististyle of male hypopygium with two unequal black spines; elements of phallosome elongate, acute at tips.

*Male*.—Length about 3.6 mm.; wing 5.2 mm.

*Female*.—Length about 3.8 mm.; wing 4.5 mm.

Rostrum obscure brownish yellow; palpi brownish black. Antennæ black throughout. Head obscure orange-yellow in front, dark brown behind, the posterior vertex and occiput with a median pale mark.

Pronotum and conspicuous lateral margins of the præscutum bright sulphur-yellow. Mesonotum dark brown, the median area of scutum, the scutellum, and anterior half of postnotal mediotergite bright sulphur-yellow. Pleura sulphur-yellow with two conspicuous dark brown longitudinal stripes, the more dorsal one extending from the propleura, passing above the halteres to the postnotal mediotergite; ventral stripe occupying sternopleurite and meron. Halteres brownish black, the knobs of the halteres indistinctly yellowish. Legs with the coxæ and trochanters obscure yellow, the outer faces of anterior ones more infuscated; legs dark brown, the femoral bases paler. Wings about as in *G. nigrohalterata*, the stigmal region a trifle darker.

Abdomen of males with the basal tergites darkened, the remainder of the organ largely orange, including the hypopygium. Male hypopygium with the style asymmetrical as

in the group. Outer style of right side a chitinized relatively short beak, near mid-length narrowed to the sub-obtuse apex, the whole structure more or less resembling the head and bill of a duck; inner style fleshy, terminating in a long fasciculate bristle. Outer style of left side flattened apically, the mesal angle produced into a powerful, gently curved, black spine, directed slightly laterad; immediately beside this spine a much smaller, straight, black spine; base of larger spine with small subappressed setæ; inner style of this side generally similar to the corresponding one of opposite side. Elements of phallosome unusually long and slender, much longer and more pointed at tips than in *nigrohalterata*; the shorter one (presumably an apophyse) with the margins from base almost to apex with small setæ; apex a chitinized spine.

*Hab.* New Zealand (South Island).

*Holotype.* ♂, Dun Mt., Nelson, altitude 3000 feet, January 5-7, 1922 (*A. Tonnoir*); collector's number 107.

*Allotopotype*, ♀.

*Paratopotype*, 1 ♂, 1 doubtful ♀.

The paratype female may not be conspecific, as the abdominal segments are dark brown with narrow yellow caudal margins.

*Gonomyia (Lipophleps) tenuistylus*, sp. n.

*Male.*—Length about 3.6 mm.; wing 4.2-4.5 mm.

Most closely related to *G. (L.) longispina*, Alexander, from which it differs chiefly in genitalic characters.

Rostrum yellow; palpi brownish black. Head dark brown, extensively variegated with sulphur-yellow. Præscutum largely brown, the scutal lobes somewhat darker brown; median area of scutum and the broad scutellum bright yellow; postnotal mediotergite largely yellow, darkened posteriorly. Pleural stripes conspicuous. Apices of knobs of halteres rather bright yellow. Male hypopygium asymmetrical as in the group. Spines of outer dististyles unusually long and slender. Outer dististyle of left side subcylindrical, narrowed to the apex, which bears a long curved spine, the base encircled by dense, short, reddish setæ. Outer dististyle of right side arising from an enlarged base, gently curved to the acute apex. Inner styli of both sides fused or closely approximated to their respective outer styles, approximately equal to one another in shape and size, setigerous, each terminating in a powerful fasciculate seta. Elements of phallosome two, very unequal in size, one (pre-

sumably an apophyse) very short, the other (presumably the ædeagus) unusually long and acutely pointed at apex.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Nelson, Nelson, November 8, 1923 (*A. Tonnoir*); collector's number 107.

*Paratopotype*, ♂, March 16, 1923 (*A. Tonnoir*).

*Gnophomyia (Campbellomyia) brevitarsis*, sp. n.

General coloration pale yellow; rostrum and scapal segments of antennæ yellow; head pale brown, the occiput and genæ paling into yellow; tarsi very short, a little less than one-fourth the tibiæ; wings nearly hyaline.

*Male*.—Length about 3.2 mm.; wing 4.2 mm.

Closely allied to *G. (C.) fulvipileura*, Alexander, both species having long slender legs with relatively short and inconspicuous trichiæ and with the tarsi unusually shortened.

Rostrum pale yellow, the palpi passing into pale brown. Antennæ short, the scapal segments light yellow, the flagellum brown; flagellar segments oval with verticils of moderate length. Vertex very broad; head pale testaceous brown, a little darker on the sides of the vertex, the occiput and genæ paling into dull yellow.

Pronotum obscure yellow, a little darkened anteriorly. Mesonotum obscure yellow, the præscutum a very little darker; pseudosutural foveæ pale, inconspicuous against the ground-colour. Halteres elongate, pale. Legs with the coxæ and trochanters light yellow; femora and tibiæ pale brownish yellow; trichiæ of the tibiæ moderately long, but subappressed and inconspicuous; tarsi pale brown; tarsi very short, the segments gradually decreasing in length, the first approximately twice the second, the second approximately twice the third, the entire posterior tarsus measuring 1.2 mm., the tibia 4.2 mm. Wings relatively narrow, nearly hyaline, the stigma ill-defined and only a trifle darker than the ground-colour; veins darker brown. Macrotrichiæ on distal third of  $R_2$  and on distal three-fourths of  $R_3$ . Venation: *m-cu* near mid-length of cell 1st  $M_2$ ; cell 2nd  $A$  long and narrow.

Abdomen pale brown, the sternites obscure yellow; eighth abdominal segment darker brown to produce a narrow subterminal ring; hypopygium obscure yellow. Hypopygium almost exactly as in the genotype, *G. (C.) alpina*, Alexander.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Nelson, Nelson, December 1921 (*A. Tonnoir*); collector's number 109.

*Gnophomyia* (*Campbellomyia*) *alpina pallipes*, subsp. n.

*Male*.—Length about 3·2 mm.; wing 5 mm.

*Female*.—Length about 3·6 mm.; wing 5·6 mm.

Differing from typical *alpina* in several details.

Antennæ pale brown. Præscutum with the produced anterior end and lateral spots behind the pseudosutural foveæ dark brown; lateral ends of scutal lobes darkened. Pleura pale, the sternopleurite and anepisternum with a conspicuous dark brown girdle; postnotal pleurotergite similarly darkened. Knobs of halteres conspicuously infuscated. Outer face of fore coxa not more infuscated than the other coxæ. Legs with the coxæ concolorous with the tibiæ, obscure brownish yellow, the tips of the basal three segments and the terminal segments weakly more infuscated. In typical *alpina* the tips of the tibiæ and all the tarsi are black. Tarsi proportionately shorter, approximately one-third the length of the tibia (posterior tibia 4 mm., tarsus 1·3 mm.); in *alpina*, the posterior tarsi are approximately two-fifths the length of the tibia (posterior tibia 5 mm., tarsus 2 mm.). Wings more greyish; cell 2nd A a trifle wider.

In some specimens, the dark lateral spot on the præscutum and the postnotal pleurotergite are not evident, but the dark vertical girdle on the anterior mesopleura is evident in all cases.

*Hab.* New Zealand (Both Islands).

*Holotype*, ♂, Aniseed Valley, Nelson, March 22, 1922 (*A. Tonnoir*); collector's number 121.

*Allotype*, ♀, Wilton's Bush, Wellington, December 2, 1921 (*A. Tonnoir*).

*Paratypes*, ♂, Khandallah, Wellington, November 30, 1921 (*A. Tonnoir*); ♂, Nelson, Nelson, March 4, 1922 (*A. Tonnoir*).

*Aphrophila trifida*, sp. n.

Size small (wing under 7 mm.); vertex broad; median præscutal carina present; coxæ grey pruinose; legs dark brown, the femoral bases narrowly paler; abdomen dark, grey pruinose, the hypopygium with the smaller plate of the gonapophyses terminating in three acute subparallel teeth.

*Male*.—Length about 4·5–4·6 mm.; wing 6·2 mm.

*Female*.—Length about 6 mm.; wing 6·5 mm.

Head clear light grey, the vertex between the eyes broad, in the male about equal to the diameter of a single eye.

Thorax higher and more gibbous than in *A. triton*. Mesonotal præscutum clear blue-grey with three dark grey stripes, the median stripe divided by a median carina. Legs with the coxæ black, grey pruinose; outer faces of trochanters infuscated; legs dark brown, only the femoral bases narrowly paler. Wings with a strong brown tinge; stigma oval, slightly darker brown, relatively ill-defined; veins darker brown. Veins with macrotrichæ on distal half of  $R_{2+3}$ ; none on basal quarter of  $M_{1+2}$  or basal third of distal section of  $Cu_1$ . Venation:  $Sc_1$  ending beyond three-fourths the length of  $Rs$ ,  $Sc_1$  about twice  $Sc_2$ ;  $r$  nearly its own length before the fork of  $R_{2+3}$ , and nearly three times its length from the tip of  $R_1$ .

Abdomen dark grey, including the hypopygium. Male hypopygium with the dististyle long and slender, narrowed to the single apical tooth. Larger plate of gonapophyses neither darkened nor serrulate at apex; smaller plate narrow, terminating in three rather long, acute, subparallel teeth, the outer pair a trifle longer and more acute, the median tooth broader and a trifle shorter, with faint indications of microscopic lateral shoulders at extreme base.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Arthur Tableland, Nelson, altitude 4500 feet, December 27, 1921 (*A. Tonnoir*); collector's number 114.

*Allotopotype*, ♀, altitude 5000 feet, December 23, 1921.

*Paratopotypes*, 1 ♂, 1 ♀, with allotype; *paratypes*, 1 ♂, Dun Mt., Nelson, altitude 3000 feet, January 5-7, 1922 (*A. Tonnoir*); 1 ♂, Waiho, Westland, January 18, 1922 (*A. Tonnoir*).

*Aphrophila trifida* bears a resemblance to *A. triton* (Alexander), differing most evidently in the smaller size, broad vertex, median carina on mesonotal præscutum, and details of structure of the male hypopygium.

#### *Aphrophila luteipes*, sp. n.

General coloration obscure brownish yellow, the præscutum with darker stripes, at least indicated antero-medially; legs with femora obscure yellow; wings tinged with brownish yellow; male hypopygium with the smaller plate of gonapophyses roughly triangular in outline, the median tooth large and conspicuous, the lateral teeth subobsolete.

*Male*.—Length about 5.5 mm.; wing 6.5 mm.

*Female*.—Length about 6 mm.; wing 7.5-8.5 mm.

♂. Antennal scape yellowish brown, the flagellum black;

flagellar segments short-oval. Vertex brown, sparsely pruinose; relatively narrow, at narrowest point less than one-half the diameter of a single eye.

Mesonotal præscutum obscure brownish yellow with three darker brown stripes, the median one not reaching the suture; median carina indicated posteriorly, but very faint; scutal lobes extensively darkened, the median area and scutellum pale; postnotal mediotergite darker behind. Pleura brownish yellow, the dorsopleural membrane somewhat clearer. Halteres pale yellow. Legs with the coxæ obscure yellow, the extreme bases weakly infuscated; trochanters yellow; femora obscure yellow, scarcely darkened apically, the surface with abundant short brown setæ; tibiæ obscure yellow, the tips narrowly brownish black; tarsi black. Wings tinged with brownish yellow, cells *C* and *Sc* a trifle darker; stigma very ill-defined, only a trifle darker than the ground-colour; veins darker brown. Macrotrichia on vein  $R_{2+3}$  near origin and on basal section of  $R_{4+5}$ ; trichia on *M* and *Cu* proximad of cord. Venation: *r* on  $R_{2+3}$  about one-half its length before the fork and on  $R_1$  a trifle more than twice its length from the tip.

Abdomen brownish black, the pleural membrane more buffy; hypopygium yellowish. Male hypopygium with the dististyle a trifle more slender than in *A. flavopygialis*, terminating in an acute blade, with a smaller subapical tooth. Smaller plate of gonapophyses roughly triangular in outline, the median tooth large and conspicuous; lateral teeth sub-obsolete, appearing as ill-defined shoulders at base of median tooth.

♀. The females that are associated with the type male probably belong here, although differing in some details of coloration. Præscutal stripes paler, only the anterior ends of the median stripes darkened; median carina indicated throughout its length. Wings with stigma well defined; in the allotype,  $Sc_2$  at extreme tip of  $Sc_1$ . Abdomen light brown, the tergites a little darker.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Alexandra, Otago, January 7, 1923 (*C. C. Fenwick*).

*Allotype*, ♀, Woodside, near Maungatua, Otago, December 15, 1923 (*W. Geo. Howes*).

*Paratypes*, ♀, Lake Manapouri, Southland, altitude 600 feet, January 1-7, 1923 (*S. Lindsay*); ♀, Waiho, Westland, altitude 600 feet, January 24, 1922 (*A. Tonnoir*); collector's number 115.

*Aphrophila tridentata*, sp. n.

General coloration pale brown, the præscutum with three darker brown stripes; præscutum with median carina; pleura obscure yellow; femora testaceous-yellow, the tips narrowly infuscated; wings tinged with pale brown; male hypopygium yellowish, the dististyle bifid at apex; smaller plate of gonapophyses terminating in three small subequal teeth.

*Male*.—Length 4·5–5·5 mm.; wing 5·5–6 mm.

Antennæ with the scapal segments yellowish brown; flagellum black, the segments short-oval. Head brownish grey, paler on the anterior vertex, the latter relatively narrow, a trifle less than one-half the diameter of one eye.

Mesonotal præscutum pale brown with three dark brown stripes, these but little evident against the ground-colour; lateral margins of sclerite and humeral region more yellowish; median carina distinct; mesonotum gibbous, the præscutum produced cephalad over the base of the head, the dorsum of the præscutum when viewed laterally plane or even feebly concave; scutal lobe dark brown, the lateral edge of the darkened portion weakly carinate; median area of scutum more testaceous; scutellum and postnotum dark brown. Pleura obscure yellow, the sternopleurite slightly infuscated. Halteres pale. Legs with the coxæ and trochanters testaceous-yellow; trochanters obscure yellow; femora testaceous-yellow, the tips narrowly but distinctly infuscated; tibiæ testaceous, the tips narrowly infuscated; tarsi with the basal two segments testaceous, tipped with darker; terminal segments uniformly dark brown. Wings with a pale brown tinge, the stigma oval, slightly darker brown; veins dark brown. Macrotrichiæ lacking on basal deflection of  $R_{4+5}$  and on base of terminal section of  $M_{1+2}$ ; chief elements of cord pale to semi-obsolete. Venation:  $Sc_2$  not far from tip of  $Sc_1$ , terminating near two-thirds the length of  $Rs$ , the latter feebly angulated at origin;  $r$  on  $R_{2+3}$  one-half or more of its length before the fork, and more than twice its length from the tip of  $R_1$ ; base of terminal section of  $M_3$  semi-obiterated.

Abdomen brown, the sternites a little paler; subterminal segments dark brown to produce a ring; male hypopygium yellowish, the extreme bases of dististyle a trifle infuscated. Male hypopygium approximating the type of *A. flavopygialis*. Dististyle relatively slender, terminating in a slender spine with a slightly smaller spine just back from tip. Smaller plate of gonapophyses long and slender,



narrowed gradually outwardly, the apex truncate and provided with three small, approximately equal teeth, the median tooth a trifle shorter and broader. The larger plate rests on three supports, with a cavity beneath.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Aniseed Valley, Nelson, December 1-4, 1923 (*A. Tonnoir*); collector's number 113 c.

*Paratypes*, 2 ♂♂, 1 ♀, Takaka, Nelson, February 6, 1920 (*R. J. Tillyard*).

The paratypes were earlier (*Ann. & Mag. Nat. Hist.* (9) vol. ix. pp. 150-151, 1923) included as paratypes of *A. flavopygialis* (Alexander), to which species the present form is closely allied.

*Aphrophila monacantha*, sp. n.

General coloration reddish brown, the præscutum with three darker brown stripes; vertex of male narrow, about equal in width to the diameter of the basal segment of scape; femora obscure yellow, tipped with black; wings tinged with pale yellow, cells *C* and *Sc* indistinctly clouded with brown; male hypopygium yellowish, the dististyle bifid at apex; larger plate of gonapophyses with a U-shaped apical notch; small plate of gonapophyses reduced to a slender spine.

*Male*.—Length 4.5-4.8 mm.; wing 6-6.8 mm.

*Female*.—Length about 6 mm.; wing about 6.6 mm.

Rostrum pale brown, the palpi dark brown. Antennæ with the basal segment of the scape reddish yellow, the apex darker; remainder of organ dark brown; flagellar segments oval. Head dark grey, the anterior vertex and orbits lighter grey; vertex between eyes very narrow, about as wide as the diameter of the first scapal segment. In the female, the vertex is a trifle wider.

Mesonotum reddish brown, the præscutum with three darker brown stripes; median carina present but ill-defined; scutal lobes vaguely darkened; scutellum obscure yellow; postnotal mediotergite blackened posteriorly. Pleura reddish yellow, the sternopleurite darker; a vague darkened area on anepisternum immediately behind the fore coxæ. Halteres pale. Legs with the coxæ and trochanters obscure brownish yellow; femora obscure yellow, the tips conspicuously blackened; tibiæ pale brown, the tips narrowly blackened; tarsi black. Wings with a pale yellowish tinge; cells *C* and *Sc* faintly infuscated; stigma oval, brown; veins pale brown, the major veins before the cord more yellowish.

Sparse macrotrichiae on  $R_{3+4}$  and the extreme tip of  $R_5$ ; numerous trichiae on basal section of  $R_{4+5}$ ; no trichiae on veins  $M$  and  $Cu$  proximad of cord. Venation:  $Sc_2$  less than half its length from tip of  $Sc_1$ , ending beyond three-fourths the length of  $R_5$ ;  $r$  on  $R_{3+4}$  close to or some distance before the fork and on  $R_1$  about twice its length from tip.

Abdomen brown, the three subterminal segments brownish black to produce a broad annulus; hypopygium obscure yellow. Male hypopygium of the general type of *A. flavopygialis*; dististyle moderately broad, with a long, slender, subterminal spine, in addition to the stouter apical one. Larger plates of gonapophyses fused together apically, the caudal margin with a U-shaped notch, the extreme caudal margin narrowly darkened, each lobe formed being obtuse to subacute. Smaller plate of gonapophyses reduced to a single slender spine, the tip moderately acute.

*Hab.* New Zealand (Both Islands).

*Holotype*, ♂, Wairakei, Auckland, March 6, 1923 (*A. Tonnoir*); collector's number 115 b.

*Allotype*, ♀, Nelson, Nelson, January 1, 1920 (*A. Philpott*).

*Paratopotypes*, 2 ♂♂; *paratype*, ♂, Nelson, Nelson, January 1, 1920 (*R. J. Tillyard*).

The allotype and paratype of *Aphrophila monacantha* had earlier (*Ann. & Mag. Nat. Hist.* (9) vol. ix. pp. 150–151, 1922) been included in the type-material of *A. flavopygialis* (Alexander), to which species the present fly is most closely allied. Of the eight species of *Aphrophila* known to the writer at the present writing, all but *monacantha*, *luteipes*, and *flavopygialis* have been taken in the Province of Nelson. There can be but little doubt that the last-named species likewise occurs, since it is entirely regional (Wellington to Westland and Otago).

#### IX.—Some Orthoptera from Pamir and adjacent Countries.

By S. P. TARBINSKY.

THE material on which this paper is based has been collected principally by Prof. N. V. Bogojavlensky during his expeditions to Pamir in 1895, 1898, and 1901. N. Bogojavlensky's collections, which are preserved in the Zoological Museum of the Moscow University, have been already partly determined by Mr. N. Zubovsky, but the results of this study

have never been published. These collections were finally worked out by me while I checked the determinations by N. Zubovsky. I include in this paper also A. Kaznakov's collections from the same places, and some of other collectors which I have been able to study at the Zoological Museum of the Academy of Sciences, Leningrad. Our knowledge of the Orthopterous fauna of Pamir is as yet very incomplete, and the publication of the results of my studies, however fragmentary, may be of interest. In the following systematic list of species I include also some species found not exactly in Pamir, but in the neighbouring countries adjoining it on the north and west, as the Orthopterous fauna of those countries is also still insufficiently known, and all new records are of great importance for the study of geographical distribution of Orthoptera in Central Asia.

The types of the new species described in this paper are preserved in the collections of the Zoological Museum of the Russian Academy of Sciences, Leningrad.

I am obliged to Mr. B. P. Uvarov for his advice on some doubtful points.

#### *Explanatory List of the Localities.*

*Saraj.*—Near the River Piang, S. Bukhara.

*Porkhar.*—

*Obigarm.*—Near to the sources of "the River Vakhsh, Bukhara.

*Tchor-soda.*—Near to the sources of the River Vakhsh, Bukhara.

*Tchil-dara.*—Near the River Chingou, E. Bukhara.

*Dubeba.*—Near to the source of the River Vakhsh, Bukhara.

*Damburatchi.*—Near to the source of the River Vakhsh ; not far from the junction of the Rivers Kizil-su and Muk-su, Bukhara.

*Tchubek.*—Near the Afghanistan frontier, S. Bukhara.

*Tshkashim.* " " " E. Bukhara (Pamir).

*Khala-i-Khout.*—Near the River Vakhsh, S. Bukhara.

*Kurgovadi.*—East from Kala-i-Khum, S. Bukhara.

*Porshniv.*—Near the River Piang, S. Bukhara.

*Chorog.*—Not far from the mouth of the River Gunt, in River Piang, E. Bukhara (Pamir).

*Sotchary.*—Near the River Piang, E. Bukhara (Pamir).

*Kala-i-Vamar.*—Near the junction of the Rivers Murgab and Piang, E. Bukhara (Pamir).

*Takh-su*.—A river in E. Bukhara.

*Taran-bazar*.—Andizhan district, Ferghana.

*Gultcha*.—Ferghana.

*Mady, Langar*.—Osh district, Ferghana.

*Rang*.—A lake, S. Ferghana (Pamir).

### Mantidæ.

#### 1. *Bolivaria brachyptera* (Pall.).

Ferghana: Langar. Two male larvæ.

#### 2. *Rivetina bætica* (Ramb.).

Bukhara: Dubeba, 6. vi.; Porkhar, 23. vii.; Saraj, 24. vii. 1898; Takh-su, vii. 1898 (*Bog.*).

#### 3. *Empusa pennicornis* (Pall.).

Bukhara: Dubeba, 7. vi.; Tchor-soda, 9. vi. 1898 (*Bog.*).

### Tettigoniidæ.

#### 4. *Phaneroptera falcata* (Poda).

Ferghana: Taran-Bazar, 3. viii. 1895 (*Korzhinsky*).

#### 5. *Conocephalus fuscus* (Fabr.).

One female has been taken by Mr. Korzhinsky from Aslyk-Ceb, Ferghana, 10. viii. 1895.

#### 6. *Tettigonia caudata* (Ch.).

Bukhara: Fajzabad-Baldjuan, 20–26. vi.; Kalaj-Vamar, Roshan, 2. viii.; Chorog, Gunt-Schachdara, Shugnan, 11. viii. 1897 (*Kaznakov*); Dubeba, 7. vi.; Obigarm, 8. vi. 1898; Takh-su, vii. 1898; Damburatchi, 12. vi.; Kala-i-Khout, 9. vii.; Chorog, 30. vii.; Porshniv, 6–8. viii.; Tshkashim, 1901 (*Bog.*).—Ferghana: Langar, 16. ix. 1878 (*Kushakovitch*); Rang, 23. vii. 1901 (*Bog.*).

#### 7. *Metrioptera intermedia* (Serv.).

Bukhara: Sotcharv, Porshniv, 6–8. viii.; Tshkashim, without date; Damburatchi, 12. vi. 1901.—Ferghana: Rang, 23. vii. 1901; Langar, without date (*Bog.*).

8. *Decticus albifrons*, Fabr.

Bukhara: Saraj, Poikhar, 23-24. vii. 1898 (*Bog.*) —  
 Ferghana: Kurshav, 25. vii.; River Kugart, 8. viii. 1895  
 (*Korzhinsky*).

## Gryllidæ.

9. *Gryllus desertus* (Pall.).

Ferghana: Gultcha, 31. vii. 1895; Mady-Langar, without  
 date; Urmitan, prov. Maracandica, 20-23. v. 1901 (*Bog.*).

The specimens from Urmitan and from Gultcha belong to  
 f. *tristis*, Serv.

## Acrididæ.

10. *Gomphomastax clavata*, Ostroum.

Bukhara: Tchil-dara, 12. vi. 1898, 1 ♀ (*Bog.*).

11. *Acrida turrita deserti*, Uvar.

Bukhara: Saraj, 24. vii.; Poikhar, 23. vii.; Obigarm,  
 8. vi.; Takh-su, vii. 1898.—Afghanistan: Mazar-i-Sheriv,  
 18. v. 1898 (*Bog.*).

12. *Stauroderus apricarius* (L.).

Bukhara: Tchil-dara, 12. vi. 1898 (*Bog.*).

13. *Stauroderus biguttulus* (L.).

Bukhara: Dubeba, 7. vi.; Tchorsoda, 9. vi.; Damburatchi,  
 Tchil-dara, 12-14. vi.; Tchubek, 22. vii. 1898.—  
 Ferghana: Langar, 1. viii. 1895; Urmitan, prov. Maracandica,  
 20-23. v. 1901 (*Bog.*).

14. *Chorthippus albomarginatus* (Deg.).

Bukhara: Dubeba, 6. vi. 1898 (*Bog.*).

15. *Chorthippus dorsatus* (Zett.).

Bukhara: Dubeba, 6. vi. 1898 (*Bog.*).

16. *Dociostaurus maroccanus* (Thunb.).

Bukhara: Dubeba, 6. vi., Tchil-dara, 12. vi. 1898; Kala-i-Khout,  
 9. vii.; Damburatchi, 12. vi. 1901 (*Bog.*).

17. *Dociostaurus crucigerus brevicollis* (Ev.).

Bukhara: Kurgovadi, 11. vii. 1898 (*Bog.*).

18. *Dociostaurus kraussi* (Jugen.).

Bukhara: Tchor-soda, 9. vi. 1898 (*Bog.*).

19. *Arcyptera microptera turanica*, Uvar.

1925. *Arcyptera flavicosta turanica*, Uvarov, Journ. Bomb. Nat. Hist. Soc. vol. xxx. no. 2, p. 60.

One male taken by Voskobejnikov at Gultcha and one female at Langar, prov. Ferghana, vii. 1895.

20. *Aiolopus thalassinus* (Rossi).

Bukhara: Porkhar, 23. vii. ; Saraj, 24. vii. 1898 (*Bog.*).

21. *Aiolopus tergestinus* (Ch.), f. *viridis*, Kitt.

Bukhara: Damburatchi, 12. vi. ; Khala-i-Khout, 9. vii. ; Porshniv, 6-8. viii. ; Chorog, 30. vii. 1901 ; Urmitan, prov. Maracandica, 20-23. v. 1901 (*Bog.*).

22. *Pyrgodera armata*, F. W.

Ferghana: Gultcha, 31. vii. 1895 (*Bog.*).

23. *Edaleus decorus* (Germ.).

Bukhara: Obigarm, 8. vi. ; Takh-su, vii. 1898 (*Bog.*).

24. *Mioscirtus wagneri*, Ev.

Bukhara: Porkhar, 23. vii. 1898 (*Bog.*).

25. *Edipoda miniata* (Pall., nec auct.).

Bukhara: Dubeba, 7. vi. ; Saraj, 24. vii. 1898 ; Kala-i-Khout, 9. vii. 1901 (*Bog.*).

26. *Locusta migratoria*, ph. *danica*, L.

Bukhara: Tchor-soda, 8. vi. ; Porkhar, 23. vii. ; Takh-su, vii. 1898 ; Chorog, 30. vii. ; Porshniv, Sotcharv, 6-8. viii. ; Tshkashim, 1901.—Ferghana: Rang, 23. vii. 1901 (*Bog.*).

27. *Sphingonotus nebulosus* (F. W.).

Bukhara: Kala-i-Khout, 9. vii.; Damburatchi, 12. vii.; Chorog, 30. vii.; Porshniv, 6-8. viii. 1901 (*Bog.*). — Ferghana: Margellan, 14-17. v. 1895 (*Bog.*).

28. *Thrinchus tuberculosus*, sp. n. (Figs. 1 & 2.)

♂. Rather slender. *Antennæ* almost twice as long as the head and the pronotum taken together (in female unknown). The *front* profile is angulately incised in the middle. Frontal ridge very narrow, well distinct throughout, between the antennæ laminate compressed, with linear sulcus, at ocellum a little dilated. *Pronotum* laterally compressed, elongated, with a thin linear carina. Fore part of the pronotum elevated,

Fig. 1.

Fig. 2.

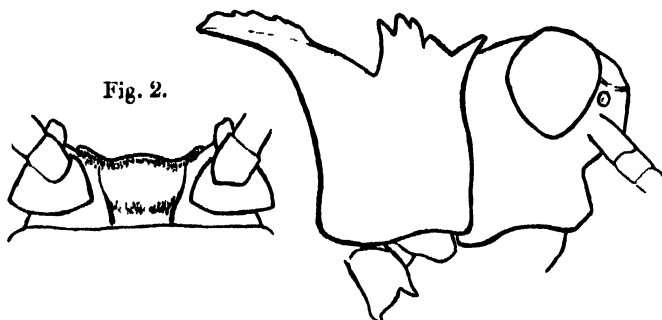
*Thrinchus tuberculosus*, sp. n.

Fig. 1.—Head and pronotum of male.

Fig. 2.—Prosternum of male.

forming four acute projections; the first of them is small and directed forward towards the occiput, the others larger, inclined backwards. The typical sulcus of pronotum is placed before the middle. Metazona raised at the apex, with rather strong tubercles; hind angle acute, with lateral margins slightly concave. Lateral lobes knobby. *Prosternum* with a small globular protuberance and waved crenulated frontal margin, projecting plate-like in total length of the fore margin and partly covering the mouth from below. *Elytra* narrowed apically. The fore border of the elytra in apical part strongly curved, the hind border concave. Venation as in *Strumiger desertorum*. *Wings* elongated, a little

shorter than elytra, slightly emarginate externally. *Subgenital plate* narrowing towards the tip, which is slightly incised.

*Coloration* brownish grey with white spots. *Antennæ* rosy. Head anteriorly, vertex and occiput darkened. Lines near the eyes on vertex white. Cheeks white, with a longitudinal dark stripe, which begins at the inferior margin of the eyes. Pronotum with two white longitudinal fasciæ above. Along the hind border of the lateral lobes runs an elevated white line, which goes on to the metazona also. Elytra straw-coloured, with grey spots and dots. Wings with a dark broad band, extending to the hind margin; the base bluish. Hind femora with two grey spots and a white stripe along its inferior keel. Hind tibiæ yellowish, inside rosy.

♀ (paratype). As the male, but the acute projections of the fore part of the pronotum, except the first, standing upright. Subgenital plate with two linear longitudinal carinæ; hind margin with a small projection.

	♂ (type). mm.	♀ (paratype). mm.
Length of body . . . . .	20	41
" pronotum . . . . .	7	10.2
" elytra . . . . .	28.2	41
" hind femora . . . . .	15	20.8

One male (type) was taken by Mr. Kaznakov at Gilembov, Kabadian, S. Bukhara, 5. v. 1897, and one female (paratype) at the same locality, 9-10. v. 1897.

## 29. *Thrinchus variegatus*, sp. n. (Fig. 3.)

♀. Clumsy. *Antennæ* only a little longer than the head and pronotum together. The head extremely rugose. The front in profile suddenly depressed at the ocellum, further down perpendicular; frontal ridge well developed only between the antennæ, from ocellum downwards obsolete. Occiput with the median longitudinal keel linear and with transverse, slender, entwining keels diverging from it. *Pronotum* above flat, sparsely granulated, its fore margin angulate-prominent; the hind margin broadly rounded. The typical sulcus placed a little before the middle of pronotum. *Prozona* a little narrower than the metazona, above with insignificant convexities. *Prosternum* flat, anterior margin slightly laminate throughout, bent vertically downwards. *Elytra* hardly narrowed apically; the hind margin straight. *Wings* broadly triangular. Hind femora short, broad; upper

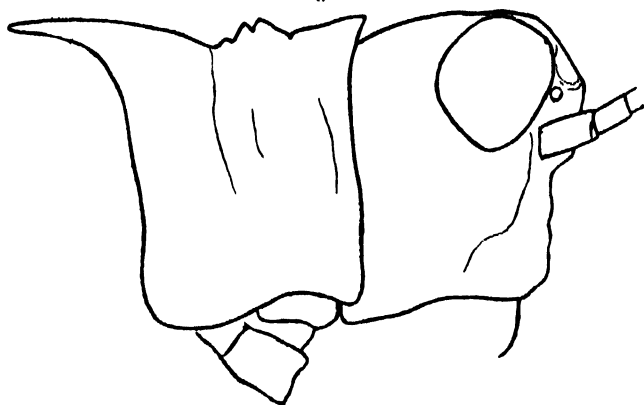


margin denticulated. *Subgenital plate* smooth, with the angles rounded and with a conical projection in the middle of its hind margin.

*Coloration* grey, with a number of white spots and dots. Antennæ white. Head whitish, darker above, anteriorly with small dark spots. Occiput orange behind. Elytra with numerous dark spots, forming in the basal part two indistinct fasciæ. Wings with a not broad fascia, the hind border of which is obtusely rounded; base of wings greenish, apex with dark veins. Hind femora outside whitish yellow, with two distinct black spots, inside purplish red. Hind tibiæ bluish outwardly, carmine-red inwardly.

	mm.
Length of body .....	47.5
„ pronotum.....	9
„ elytra .....	39
„ hind femora .....	17.4

Fig. 3.

*Thrinchus variegatus*, sp. n.

Head and pronotum of female in profile.

A single female from Andizhan, Ferghana, 1917.

The genus *Thrinchus* was established in 1833 by Fisher v. Waldheim (Bull. Mosc. pp. 363, 378), with one species in it—*Th. campanulatus*,—this being the genotype; but later on he included in it some species referred now to the genus *Tmethis*, Fieb., as well. Saussure (1884) confirmed the independence of the genus, and included in it only two species, namely, *Th. schrenkii* and *campanulatus*. In 1896 N. Zubovsky described the genus *Strumiger*, with the type

*Str. desertorum*, which is very closely related to *Thrinchus*, F. W., differing from it mainly by the structure of the prosternum. Notwithstanding the absence of the other characters separating these two genera, the structure of prosternum is so typical for each of them that it is not possible to unite them. At the same time little attention was paid by preceding investigators to this character, and I would like to rectify here this omission, the more so as one of the new species—*Th. tuberculosus*—has the prosternum also distinctly prominent in middle (strumosum). In the following key I give the relations of these genera and of the four species of *Thrinchus* at present known to us:—

*Key to Species of Thrinchus, F. W., and Strumiger, Zub.*

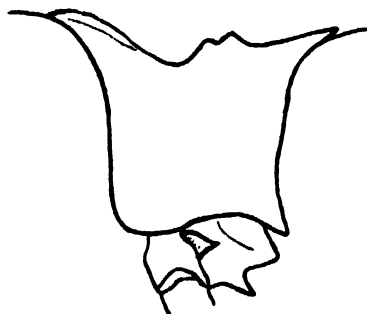
- 1 (8). Prosternum in the middle not prominent, but sometimes slightly spherically convex, its fore border laminate, collar-shaped, hanging down. Episternum slightly protruding from pronotum, distinctly separated, its front lower margin slightly prominent, rotundate, separated from the front margin of prosternum (figs. 1-3). The front lower angle of the lateral lobes of pronotum is right or nearly so. . . . . [Fisch. W.  
Genus *Thrinchus*,
- 2 (3). The lower part of the front, seen in profile, under ocellum vertical, not protruding forward, with coarse elevated granules and tubercles; the keels of the frontal ridge under ocellum tuberculate. Pronotum slightly laterally compressed, above flat, without distinct projections; hind margin of pronotum broadly rounded . . . . . *T. variegatus*, Tarb.
- 3 (2). The lower part of the front, seen in profile, distinctly prominent; thus the front appears to be excised angularly; the keels of the frontal ridge under ocellum continuous, very distinct. Pronotum rather strongly laterally compressed; prozona considerably narrower than metazona, above with strong projections.
- 4 (7). The frontal ridge between the antennæ thick, sulcate. Pronotum broad, shortened; metazona above flat, with hardly noticeable tubercles, its lateral margins straight. The wings broadly triangular.
- 5 (6). Smaller. Prozona with the projections not strongly elevated; metazona in anterior part with slight knobs, in posterior one with low longitudinal wrinkles. Wing-fascia reaches the hind margin. . . . . [Fisch. W.  
*T. campanulatus*,

- 6 (5). Larger. The projections of prozona large, with strongly incised sulci between them, in profile tridentated. Metazona almost flat or with feeble knobs. Transverse fasciæ of the wings not reaching the hind margin of wings. *T. s hrenkii*, Fisch. W.
- 7 (4). The frontal ridge between antennæ laminate, narrowly sulcate. Pronotum laterally compressed, elongated; the lateral margins of metazona concave; posterior part of metazona elevated, with rather large tubercles along the median keel; prozona with very strong sharp projections ..... *T. tuberculatus*, Ta. b.
- 8 (1) Prosternum in the middle strongly inflated; its laminate fore margin, stretching forwards, covers the mouth. Episterni strongly developed, acute-angulate, joined to the fore border of prosternum. The front lower angle of the lateral lobes of the pronotum strongly attenuate, pointed (figs. 4 & 5). *Strumiger desertorum*, [Zub.

Fig. 5.



Fig. 4.



*Strumiger desertorum*, Zub.

Fig. 4.—Pronotum in profile of male.

Fig. 5.—Prosternum of male.

### 30. *Pyrgomorpha conica* (Oliv.).

Bukhara: Porkhar, 23–24. vii.; Tchubek, 22. vii. 1898;  
Piandgekent, prov. Maracandica, 17. v. 1898 (*Bog.*).

### 31. *Oxya turanica*, Uvar.

Bukhara: Porkhar, 23. vii. 1898 (*Bog.*).

One male and one female from Porkhar agree perfectly with the specimens from Osh and from Samarkand, which

are preserved in the Zoological Museum of the Moscow University, and which Mr. B. Uvarov \* considered to belong to his *Oxya turanica*.

32. *Conophyma semenovi*, Zub.

Ferghana: Langar (*Bog.*).

33. *Conophyma fedtschenkoi*, Zub. (Fig. 6.)

♂. The whole body slightly pilose. Antennæ as long as the head and pronotum taken together. Head smooth. Vertex strongly sloping. Front strongly reclinate; frontal ridge slightly sulcate. Pronotum, mesonotum, and metanotum practically smooth, with shallow punctures, with three distinct transverse sulci, with the median carina reaching only the hind typical sulcus. Lateral carinæ of the pronotum straight, converging posteriorly, present only in front of the first transverse sulcus, behind it obsolete. Hind margin of pronotum slightly incised. Mesonotum and metanotum above with shallow punctures and with an indistinct keel in the middle. Hind margin of metanotum slightly incised. The last tergite with broadly separated triangular lobes. Supra-anal plate transverse, with the lateral margins concave and the hind angles rounded, in the middle with longitudinal elevation; hind margin of the plate in the middle with a broad projection. Cerci long, twice as long as the supra-anal plate.

*Coloration* above dark brown with yellow stripes, below straw-yellow; front yellowish. Behind the eyes there are narrow yellow slanting stripes, extended partly on to the pronotum. The upper half of the lateral lobes is dark. Mesonotum and metanotum at the sides with distinct yellow stripes. Hind femora above brownish yellow with dark keels. Hind tibiæ reddish with brown-tipped spines. Abdomen above with three yellow longitudinal fasciæ (lateral fasciæ represent the continuation of those on the meso- and metanotum).

♀. As the male, but differs from it in the following characters:—Antennæ a little shorter than the head and pronotum taken together. Vertex slightly sloping, front scarcely reclinate. Pronotum, mesonotum, and metanotum with low obsolete median keel; hind margin of pronotum rotundate. Abdomen above with an indistinct median carina.

*Coloration* above brownish green with yellow stripes,

\* B. P. Uvarov, "Ueber die Orthopterenfauna Transcaspiens," *Horae Soc. Ent. Ross.* xl, 3, 1912, pp. 28-30.

below straw-yellow. The lateral lobes only with a narrow dark stripe in upper half. Mesonotum and metanotum at the sides with indistinct yellow stripes. Valves of the ovipositor with dark tips, the lower ones dentate.

	♂ ♂. mm.	♀ ♀. mm.
Length of body. . . . .	18·6 19	22 24·6
" pronotum. . . . .	3·7	4·5 5
" hind femora. . . .	10·6	12-13·8

Bukhara: Dgar-Tepe-Gissar, 17. v. 1897; Ai-Bulak, ridge Baba-Tau, 18. v. 1897; Ak-Metchet, Perovsk dist., 1897, 1 ♂ and 1 ♀ (*in copula*) (all taken by Mr. Kaznakov).

The female of this species was previously unknown, and I give its description as well as redescription of the male, as the original one by Zubovsky was very short.

Fig. 6.

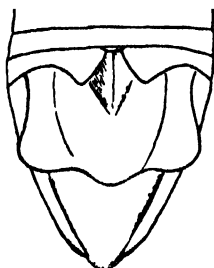
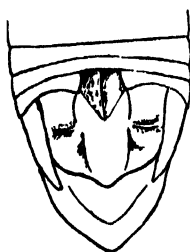


Fig. 7.

Fig. 6.—*Conophyma fedtschenkoi*, Zub., ♂.Fig. 7.—*Conophyma bogojavlenskii*, sp. n., ♂.

### 34. *Conophyma bogojavlenskii*, sp. n. (Fig. 7.)

♂. Similar to *C. simile*, Zub. Whole body scarcely pilose. Antennæ longer than the head and pronotum together. Head smooth, dull; occiput convex. Vertex flat, without longitudinal lateral keels, sloping. Frontal ridge feebly impressed. Pronotum convex, coarsely rugose, its hind margin slightly excised. The median keel anteriorly slightly convex in profile. Lateral carinæ gradually convergent backwards, very distinct in front of the middle transverse sulcus, farther back displaced, obsolescent. Prozona more than twice as long as the metazona. Mesonotum flat, without the median carina. Metanotum and the first tergite with three obsolete keels. The hind margin of metanotum practically

straight. All other tergites of the abdomen with a very distinct median keel. *Legs* with scattered short hairs. The last tergite with broadly separated small lobes. The supra-anal plate trapezoidal, narrowing towards the end with elevated lateral margins, with a strong triangular median impression at the base, and with two elevated transverse rollers; hind angles of the plate rounded, hind margin semicircular, with a short projection in the middle. The conical cerci, compressed at the sides, reach the apex of the projection of the anal plate.

*Coloration* above olivaceous-brown, unicolorous, below milky-yellow. The front, mouth-parts, and cheeks whitish yellow. Lateral lobes of the pronotum with a shining black fascia, straw-coloured below. Hind femora straw-coloured, darker above, with two indistinct dark spots, yellow underneath; hind knees dark; hind tibiae yellowish brown.

♀. As the ♂, but darker and more pilose. Antennæ as long as the head and the pronotum together. Lateral keels of pronotum parallel as far as the first transverse sulcus. Metanotum with the hind margin distinctly excised, with a middle keel and with hardly distinct lateral keels. The first tergite with scarcely distinct keels. Legs strongly pilose. Hind femora dark, below red. Hind tibiae red or pinkish. The valvæ of the ovipositor short and smooth.

	♂ (type). mm.	♀ (paratype). mm.
Length of body .....	18.8	19
" pronotum .....	3	3.6
" hind femora .....	8.2	8.5

One ♂ and two ♀ of this species have been taken by I. Vasiljev at Kara-kul, Ferghana, Pamir, 2500–3000 met., 7. viii. 1909.

This species is named by me in honour of Mr. N. V. Bogojavlensky, Professor of the Moscow University, and it differs from *C. simile*, Zub., in the following characters:—

More clumsy. Vertex flat. Pronotum more rounded and more wrinkled. Frontal ridge almost flat. The anal plate is in *C. simile* square and almost flat, with slight elevation in the middle only. The hind margin of the anal plate of *C. simile* is strongly concave at the sides of long median projection, with very distinct hind angles, while the new species has the hind margin of anal plate semicircular, with rounded angles.

35. *Conophyma weberi*, Zub.

Vakhan, Schugnan, E. Bukhara (Pamir), 7. viii. 1897 (*Kaznakov*).

36. *Anacridium ægyptium* (L.).

Bukhara: Saraj, 24. vii.; Porkhar, 23. vii. 1898 (*Bog.*).

37. *Calliptamus italicus* (L.).

Bukhara: Saraj, 24. vii.; Porkhar, 23. vii.; Takh-su, vii.; Tchubek, 22. vii.; Kurgovadi, 11. vii. 1898; Damburatchi, 12. vi.; Sotchary, Porshniv, 6-8. viii.; Kala-i-vamar, 4. viii. 1901; Ishkastim, 1901.—Ferghana: Rang, 23. vii. 1901 (*Bog.*).

38. *Thisæcetrinus pterostichus* (F. W.).

Bukhara: Tchubek, 22. vii.; Saraj, 24. vii. 1898 (*Bog.*).

**Acrydiidæ.**39. *Acrydium tartarum* (Bol.).

Bukhara: Tchorsoda, 8. vi. 1898; Kala-i-Khout, 9. vii. 1901 (*Bog.*).

40. *Acrydium subulatum* (L.).

Ferghana: Gultcha, 2. vii. 1895 (*Voskobeinikov*).

X. — *On a new Species of Earthworm belonging to the Subgenus Bimastus from Wicken Fen.* By G. E. PICKFORD, Newnham College, Cambridge.

IN August 1925, while collecting in clayey soil under some rotting sedge near Breed Fen Drove, Wicken, I obtained six specimens of a very small colourless earthworm, which proved on examination to be a hitherto undescribed species of the subgenus *Bimastus*. Three specimens were dissected, and one was cleared in cedarwood oil; the results of

dissection were confirmed by a fifth specimen which was sectioned. The dorsal pores, which were excessively minute, could only be seen with certainty in the sections. The fixation was not sufficiently good for the examination of structural detail, as of the large pharyngeal glands which extend back to segment 7 or 8 and have long coiled ducts.

For notes on the ecology of this and other Wicken species of earthworm, the reader is referred to the forthcoming volume, Part III. of the 'Natural History of Wicken Fen' (Bowes & Bowes, Cambridge).

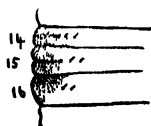
*Allolobophora (Bimastus) icenorum*, sp. n.

Length, after preservation in formalin, about 30 mm.; diameter about 1 mm.; segments c. 90. Colourless, the clitellum more opaque than the other parts. Prostomium epilobic (fig. 1). Setæ closely paired. First dorsal pore

Fig. 1.



Fig. 2.



*Allolobophora (Bimastus) icenorum*, sp. n.

Fig. 1.—Prostomium.

Fig. 2.—Region of genital pores.

intersegments 11/12. Male pores on segment 15 above the setal line *b*, in a groove raised on prominent papillæ, which extend over the greater part, if not the whole, of segments 14 and 16 (fig. 2). Female pores on segment 14 just above the setal line *b*. Clitellum extending over segments 25 or 26–31 or 32, without bands, or with the merest traces of marginal thickening on segments 28, 29, and 30 (fig. 3).

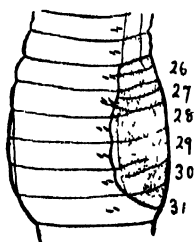
Calciferous glands in segment 10, crop in segment 15, and gizzard in segments 16 and 17. Last pair of hearts in segment 13. Testes and sperm-funnels free in segments 10 and 11. No seminal vesicles were observed. Spermathecae absent. Ovaries and large oviducal funnels in segment 13.

*Distribution.* Wicken, Cambridgeshire.



*Relationships.* This species might be confused with *A. (B.) constrictus*, Rosa, or *A. (B.) eiseni*, Levins, owing to the position of its clitellum; but it is readily distinguished from both by its pallor. From *A. constrictus* it is also distinguished by the close pairing of the setæ, and from *A. eiseni* by the form of the prostomium. It differs from all other species of *Bimastus* either in the backward position of the clitellum or in the absence of well-marked puberty-bands or tubercles. The absence of seminal vesicles is remarkable, and, should it prove constant, sufficiently distinctive to be of subgeneric value. For the present it seems better to regard this species as a rather aberrant member of the subgenus *Bimastus*. It should be observed that free sperm were observed in the cœlom as well as on

Fig. 3.



Ventral view of clitellum.

the sperm-funnels in segments 10 and 11 of the sectioned specimen.

Since the publication of Michaelsen's volume in the 'Tierreich,' three new species and one new variety of *Bimastus* have been described. To these references are given in the Bibliography.

#### BIBLIOGRAPHY.

- CHINAGLIA, L. 1913. Tor. Bull. Mus. anat. zool. xxviii. N. 667.  
 [*A. (B.) pantaleonis*, Sardinia.]  
 MICHAELSEN, W. 1900. Das Tierreich. Oligochæta.  
 ——. 1910. Zur Kenntnis der Lumbriciden und ihrer Verbreitung.  
 [Annuaire Mus. St. Pot. xv.]  
 ——. 1915. Die Lumbriciden. Zool. Jahrb. Syst. xli.  
 SMITH, F. 1915. Urbana Bull. Ill. Lab. Nat. Hist. x. [*A. (B.) gieseleri*, var. *hempehi*, Illinois.]  
 —, and GITTINS, E. M. 1915. Urbana Bull. Ill. Lab. Nat. Hist. x.  
 [*A. (B.) zoloti* and *A. (B.) longicinctus*, Illinois.]  
 STEPHENSON, J. 1923. Fauna of British India. Oligochæta.

XI.—*A Comparative Study of the Otoliths of the Neopterygian Fishes* (continued). By G. ALLAN FROST, F.L.S., F.G.S., F.Z.S.

[Plate IV.]

III. Order APODES.

The order Apodes, regarded by Mr. Tate Regan as an offshoot of the order Isospondyli \*, contains many fishes of great rarity, and it has been possible to examine the otoliths of comparatively few species. The sagitta is the principal otolith, the lapillus and asteriscus being diminutive or microscopic, and unsuitable for comparative purposes. The otoliths described are of three types :—

1. *The “Anguillid.”*—The sagitta resembles those of the Clupeoidea; form ovate, with an anterior rostrum, and generally an antirostrum and excisura; posterior end pointed; sulcus opening on the anterior rim, divided into ostium and cauda, the latter being the longer.

Type-example, *Anguilla vulgaris* (Pl. IV. fig. 1).

2. *The “Congrid.”*—Shape variable; no rostrum, antirostrum, or excisura; posterior end pointed or bifurcate, rounded in the Muraenocidæ; sulcus undivided, separated by a marginal area from anterior rim. In the Congridæ the anterior part of the sulcus is connected by a groove with the dorsal rim.

Type-example, *Conger vulgaris* (Pl. IV. fig. 10).

3. *The “Heterenchelid.”*—Sagitta resembles those of certain Myctophidæ; shape ovate, broad, biconvex; no rostrum, antirostrum, or excisura; sulcus broad, not extending to anterior rim, divided into ostium and cauda of equal length; no dorsal groove.

Type-example, *Heterenchelys macrurus* (Pl. IV. fig. 7).

Type 1. *The “Anguillid.”*

In *Anguilla vulgaris* of the family Anguillidæ the sagitta is very inconstant in shape and the sulcus is variable.

A representative example is shown in Pl. IV. fig. 1; the shape is ovate, with the outer side concave and smooth and the inner side convex; the dorsal and ventral rims are

\* Ann. & Mag. Nat. Hist. ser. 8, vol. x. p. 378 (1912).

curved, are often irregular or serrated, and the posterior rim is pointed. The anterior rim consists of a pointed rostrum, a smaller antirostrum, and a wide excisura. The sulcus opens widely on the anterior rim; the ostium is shorter than the cauda, which is long, oblique, and narrow, has a median groove, and does not reach the posterior rim. In young examples the sagitta is ovate or round, the anterior rim is usually flattened, and the sulcus is oblique. In the adult the form is generally similar to that shown in fig. 1, though the posterior rim may be rounded, and the sulcus may be straight or curved, and in some examples reaches the posterior rim; in some aged eels (Pl. IV. fig. 2) the dorsal rim becomes domed, the rostrum and antirostrum rounded, and the excisura filled out; the posterior point is also lower; the sulcus may become widened, with the upper edge domed. Thus, although the average otolith shows a distinct resemblance to that of *Clupea harengus*, and the sulcus is of the Elopine type, otoliths of aged examples approach the form presented in the otoliths of *Chirocentrus*, the median groove of the sulcus being a persistent feature in both. The lapillus (Pl. IV. fig. 3)\* resembles the conchoidal lapilli of the Ariidæ: the asteriscus (fig. 4) is slight and upright as in the Elopidae, but is slightly different in form.

In *Myrus vulgaris* (Pl. IV. fig. 5) of the family Myrocongridae, the sagitta resembles that of *Anguilla*, but has a broader rostrum and a very slight excisura and antirostrum. The sulcus is broad, and has an angle in the upper and lower edges; the ostium is distended, and is enclosed by a præsulcal marginal area; the cauda is curved and has the end rounded. The distension of the ostium gives a club-like form to the sulcus, which also occurs in *Moringua* and *Ophichthys*.

The symmetrical sagitta of *Moringua raitabonia* (Pl. IV. fig. 9) resembles that of *Myrus*, but is less elongated; the anterior rim consists of a rostrum, antirostrum, and excisura. There is an anterior constriction of the ostium and a marginal area between it and the point of the rostrum; the cauda is slightly curved, with rounded end.

In *Ophichthys gomesii* (Pl. IV. fig. 12) of the family Ophichthyidae, the shape is ovate and biconvex; the anterior rim resembles that of *Myrus*, and the posterior rim is bifurcated. The opening of the sulcus is constricted as in

\* The magnification of the smaller otoliths is twice that of the sagittæ.

*Moringua*, but the ostium is more depressed, and the cauda is broader and shorter; the end is rounded.

In *Ophichthys boro* (Pl. IV. fig. 13) the shape is elongated, the posterior part being produced and pointed; the outer side is concave and furrowed, and the inner side is convex. The ventral rim is concave and irregular. The sulcus does not cut the anterior rim, and its end is pointed.

In *Gymnothorax pictus* (Pl. IV. fig. 6), of the family Murænidæ, the shape resembles that of certain aberrant forms occurring in *Anguilla*. The otolith is narrow and elongated; the outer side is concave, and the inner side is convex. The dorsal rim is curved, forming an angle with the anterior rim; the ventral rim is irregular; the anterior rim is upright, and the posterior rim of the otolith is pointed. Anteriorly there is a slight truncated rostrum, but no antirostrum or notch. The sulcus is straight, and opens widely on the anterior rim; the ostium is short and depressed, and a narrow passage leads to the cauda which is dilated and is pointed at the end.

*Muræna augusti* (Pl. IV. fig. 16) resembles *Gymnothorax*, but differs in the following features: the dorsal rim is more curved, and the anterior rim is concave; there is a prominent antirostrum, extended beyond the truncated rostrum, and the posterior process is rounded. The sulcus opens on the anterior rim as in *Gymnothorax*; the cauda also agrees, but has a slight upward inclination; the end is pointed.

### Type 2. The "Congrid."

In *Murænosox talabon* (Pl. IV. fig. 8), of the family Murænosocidæ, the shape of the sagitta is ovate, the outer side being convex and the inner side nearly flat. The dorsal rim is curved, and there is a concavity on the posterior part, behind which it is raised and forms an angle with the posterior rim; the ventral rim is curved and the posterior rim rounded; the anterior rim is oblique and irregular, with the lower part blunt and produced. The sulcus is oblique, shallow, of uniform width, undivided, and rounded anteriorly and posteriorly; it does not reach the anterior rim of the otolith. There is no dorsal groove as in the Congridæ.

In *Conger vulgaris* (Pl. IV. fig. 10), of the family Congridæ, the otolith is elongated, the outer side ridged and straight, the inner side slightly convex. The dorsal rim is high medianly, concave anteriorly, and straight or

oblique posteriorly ; the ventral rim is curved or irregular ; the posterior rim may be oblique, pointed, or bifurcated ; and the anterior rim is oblique or rounded. The sulcus resembles that of *Muraenosox*, being oblique and undivided, and rounded anteriorly ; but differs in the inferior edge being depressed posteriorly, and in the termination being deepened and heavily ridged. There is a narrow groove connecting the anterior end of the sulcus with the dorsal rim.

In *Uroconger lepturus* (Pl. IV. fig. 11), of the same family, the otolith is biconvex, and the outline rhomboidal—it is pointed posteriorly and anteriorly, the dorsal rim has a high median angle, it is curved posteriorly and oblique anteriorly ; the ventral rim is angular and more obtuse than the dorsal rim, and the sides are more curved. The sulcus is oblique and undivided, and is shallow anteriorly, disappearing some distance from the anterior point of the otolith ; the end is rounded ; the sulcus is smaller than in *Muraenosox*, and there is a groove as in *Conger vulgaris* connecting its anterior part with the dorsal rim.

G. G. Bassoli \* has described some fossil forms of otoliths from the Pliocene of Monte Gibio, Italy, as (*Ophidium*) *appendiculatus* and (*Oph.*) *pantanellii*, but an examination of his figures shows that these should be referred to the family Congridæ ; another form described as (*Oph.*) *magnus* shows a sulcus which is nearly identical with that of *Conger vulgaris*.

The otoliths of *Congromuræna balearica* (Pl. IV. fig. 15), of the family Congridæ, are roughly circular ; the outer side is smooth, and has a large median umbo, below which it is concave ; the inner side is convex. The dorsal rim is domed, depressed and straight anteriorly, and low and oblique posteriorly ; the ventral rim is keeled, forming an angle with the posterior rim, and passing into the anterior rim ; the anterior rim is curved and irregular, and the posterior rim is small and concave. There is a well-defined canal connecting the enclosed ostium with the dorsal rim, as in *Conger* and *Uroconger*.

Fossil forms resembling this species occur in the Pliocene formations, and have been ascribed to the Macruridæ ; but the dorsal channel from the ostium and the smooth outer side show that they should be referred to the Congridæ ; similar forms also occur in the Upper Eocene of Barton, Hampshire.

\* Riv. Ital. Paleont., Perugia, Anno xii. Tav. 1 (1900).

Type 3. The "*Heterenchelid*."

In *Heterenchelys macrurus* (Pl. IV. fig. 7), of the family Heterenchelidæ, the outline of the sagitta is ovate, the outer side is slightly convex, and the inner side strongly so. The dorsal rim is curved, passing into the anterior rim and forming a slight angle with the posterior rim; the ventral rim is curved, and passes into the anterior and posterior rims; the posterior rim is rounded, and the anterior part of the otolith is obtusely pointed. The sulcus is wide, shallow, and of uniform width; it is divided by a diagonal groove into ostium and cauda, which are of equal length. The ostium extends nearly to the anterior rim, but does not cut it. The cauda terminates near the centre of the inner side, the lower edge being incurved, and the end rounded. This form resembles in general appearance the otoliths of the Myctophidæ, belonging to the order Iuomi, but differs in the convexity of the inner side and in the unbroken line of the anterior rim.

In the deep-sea species *Synaphobranchus bathybius* (Pl. IV. fig. 14), of the family Synaphobranchidæ, the form is ovate and biconvex; the dorsal rim is concave, the ventral rim is curved and forms an angle with the posterior rim, the posterior rim is oblique, and the anterior rim obtusely pointed. The sulcus is divided and deeply excavated; the ostium is ovate, and there is a marginal area between it and the anterior rim of the otolith, the cauda is circular and wider than the ostium. This otolith resembles that of *Heterenchelys*, but differs in its greater thickness, in the depth of the sulcus, and in having a raised marginal area anterior to the ostium.

## SUMMARY.

I. The sagitta is the principal otolith in the order Apodes, the lapillus and asteriscus being diminutive as in the Isospondyli.

II. The otoliths are of three types, which may be characterized as:—

1. The "*Anguillid*," resembling the otoliths of the Clupeoidea:—Anguillidæ, Myrocongridæ, Murænidæ, Moringuidæ, and the Ophichthyidæ.
2. The "*Congrid*":—Congridæ and Murænosocidæ.
3. The "*Heterenchelid*":—Heterenchelidæ and Synaphobranchidæ.

I wish to acknowledge with many thanks the use of

material kindly supplied by the British Museum (Nat. Hist.) and the help I have received from Mr. C. Tate Regan, F.R.S., and Mr. J. R. Norman in preparing this paper.

## EXPLANATION OF PLATE IV.

- Figs.* 1, 2. *Anguilla vulgaris* (sagitta),  $\times 5$ .  
*Fig.* 3. — — (lapilli),  $\times 10$ .  
*Fig.* 4. — — (asteriscus),  $\times 10$ .  
*Fig.* 5. *Myrus vulgaris* (sagitta),  $\times 5$ .  
*Fig.* 6. *Gymnothorax pictus* (sagitta),  $\times 7$ .  
*Fig.* 7. *Heterenchelys macrurus* (sagitta),  $\times 5$ .  
*Fig.* 8. *Muraenosa talabon* (sagitta),  $\times 2$ .  
*Fig.* 9. *Moringua rantabona* (sagitta),  $\times 7$ .  
*Fig.* 10. *Conger vulgaris* (sagitta),  $\times 2$ .  
*Fig.* 11. *Uroconger lepturus* (sagitta),  $\times 3$ .  
*Fig.* 12. *Ophichthys gomesii* (sagitta),  $\times 7$ .  
*Fig.* 13. — boro (sagitta),  $\times 7$ .  
*Fig.* 14. *Synaphobranchus bathybius* (sagitta),  $\times 6$ .  
*Fig.* 15. *Congromuraena balearica* (sagitta),  $\times 3\frac{1}{2}$ .  
*Fig.* 16. *Muraena augusti* (sagitta),  $\times 6$ .

XII.—Notes on *Fossorial Hymenoptera*.—XLI.

By ROWLAND E. TURNER, F.Z.S., F.E.S.

## Family Scoliidae.

## Subfamily ANTHOBOSCINÆ.

*Anthobosca silvicola*, sp. n.

♀. Nigra, pallide fulvo-pubescent; tergitis secundo tertioque fascia angusta mediana, in medio lato interrupta, pallide flava; tarsiis fusco-ferrugineis; metanoto apice sordide flavo; alis fusco-hyalinis, venis fuscis.

Long. 16 mm.

♂. Niger, albido-pubescent; mandibulis dimidio basali, clypeo, apice nigro, pronoto macula transversa utrinque, metanotoque fascia transversa flavis; mandibulis apice, femoribus tibiisque anticis subtus unguiculisque fusco-ferrugineis; tarsiis anticis pallide ferrugineis; alis hyalinis, leviter infumatis, venis fuscis, stigmatibus fusco-ferrugineo.

Long. 14 mm.

♀. Clypeus truncate at the apex, convex and longitudinally subcarinate at the base, with a broadly triangular depression before the apex; mandibles with long fulvous setæ on the outer margin. Head shining, rather sparsely punctured, the

punctures much closer above the base of the antennæ. Pronotum coarsely and closely punctured, mesonotum and scutellum as strongly, but much more sparsely punctured. Propleuræ shallowly, mesopleuræ more strongly punctured; median segment both on the dorsal surface and on the sides very finely and closely punctured. Tergites shining, closely and finely punctured at the base, sparsely and more coarsely at the apex, the second sternite shining and almost smooth in the middle, the apical margin of the sternites with a fringe of long pale fulvous hairs. Pygidium densely clothed at the base with coarse black hairs, the apex broadly rounded. Tarsal unguis bifid; hind coxæ almost contiguous. Radial cell rather narrowly rounded at the apex; third abscissa of the radius as long as the first and second combined.

♂. Clypeus convex, subtruncate at the apex, not toothed; eyes widely and very feebly emarginate on the upper part of the inner orbit; the head closely punctured and clothed with pale long hairs. Third joint of the flagellum as long as the first and second combined, antennæ short (5.5 mm.) as compared with the length of the costa (10.5 mm.). Thorax rather finely punctured, more strongly and sparsely on the mesonotum than elsewhere, pleuræ finely and closely punctured. Abdomen very minutely and closely punctured on the basal tergites, more strongly on the two apical tergites; the hypopygium linguiform. Tarsal unguis bifid. Wings clothed with very minute dark hairs; the scar dividing the first cubital cell distinct.

*Hab.* Port St. Johns, Pondoland; 1 ♀, January 1924, 1 ♂, December 1923.

One of each sex taken in dense forest.

I have been able to examine specimens of Cameron's *Anthobosca* (*Odontothynnus*) *bidentatus*, and find that the tarsal unguis are deeply bifid, not simple as he states.

*Anthobosca bidentata*, Cam.

*Odontothynnus bidentatus*, Cam. Rec. Albany Museum, i. p. 162 (1904). ♂.

*Anthobosca natalica*, Turn. Trans. Ent. Soc. London, p. 85 (1908). ♀.

I took both sexes of this species at Umtata in February 1923, and have no doubt that the sexing is correct. The colour is very variable, some of the males having tergites 2-5 broadly banded with yellow, instead of wholly black as in the typical form; and in one specimen of the female the second and third abdominal segments are bright ferruginous red instead of black.



*Anthobosca hæmatura*, sp. n.

♀. Nigra; mandibulis fusco-ferrugineis, apice nigris; orbitis internis linea brevi maculaque parva utrinque supra oculos pallide flavis; tergitis quinto sextoque sternitoque sexto rufo-ferrugineis; alis fusco-hyalinis, venis fuscis.  
Long. 13 mm.

♀. Clypeus moderately convex, subtruncate at the apex; head punctured, very sparsely and finely on the vertex and round the ocelli, more strongly and closely on the front. Pronotum closely and rather strongly, mesonotum and scutellum more sparsely punctured; median segment subopaque, very closely and minutely punctured, a small space in the middle of the basal margin almost smooth, a low oblique carina on each side from the base to the stigma. Tergites shining minutely punctured, almost smooth at the apex, the punctures on the sternites large but sparse; sixth tergite broadly rounded at the apex, coarsely punctured and closely clothed with golden setæ. Radial cell broadly rounded at the apex, second abscissa of the radius long, only a little shorter than the third, which is about equally long on the cubitus and the radius.

*Hab.* Portuguese East Africa, Valley of Kola River, Mt. Chiperrone, 1500–2000 feet, April 6, 1913 (*S. A. Neave*).

*Anthobosca iheringi*, Sauss.

*Cosila iheringi*, Saussure in Grandidier, *Hist. Madagascar*, xx. p. 231 (1892). ♀.

In a previous paper I sank this name as a synonym of *A. antennata*, Sm., but this is incorrect, the antennæ of the male in *iheringi* measuring fully two-thirds of the length of the costa of the fore wing, whereas in *antennata* they are not more than half the length of the costa.

The length of the antennæ in the male is a most important character in this genus, as also in *Myzine*.

Subfamily *ELIDINÆ*.*Elis (Mesa) euryclea*, sp. n.

♀. Nigra; capite thoraceque rugoso-punctatis, sparse fusco-hirtis; segmento mediano subnitido, coriáceo, apice crasse punctato, lateribus striato; abdomine nitido, sparse punctato, sparsissimo albedo-piloso; pygidio rugoso-striato; antennis aurantiacis; mandibulis ferrugineis, apice nigris; alis atro-cæruleis.  
Long. 17 mm.

♀. Head and thorax very coarsely rugosely punctured; the clypeus finely punctured, with a low median carina; scape with large setigerous punctures beneath, very sparsely punctured above. Median segment coriaceous at the base and almost shining, with the usual margined longitudinal groove, the extreme apex and the oblique posterior slope strongly and closely punctured, the sides of the segment strongly striated. The segment measured in the middle is considerably longer than the scutellum, in this point, as well as in the sculpture, differing from the similarly-coloured but smaller *E. xanthocera*, Gerst. Abdomen shining, very sparsely punctured; fifth tergite more closely but finely punctured; pygidium longitudinally rugose-striate, with punctures at the base. Sternites 3-5 more closely punctured, the sixth sternite finely punctured. Hind tibiae very strongly spinose without, calcaria white; basal joint of the hind tarsi with a scopula of short whitish hairs beneath. Second abscissa of the radius about equal to the third.

*Hab.* Mlanje, Nyasaland, February to April (*S. A. Neave*); Valley of Kola River, near Mt. Chipirone, Portuguese East Africa, April 1913 (*S. A. Neave*).

Described from eight females, seven of which, including the type, are from Mlanje.

Very similar in colouring to *E. xanthocera*, but is a much larger species, differing also in the sculpture and length of the median segment, in the sparser puncturation of the abdomen, and in the longer second abscissa of the radius. The male cannot yet be associated with the female, though *E. diversicornis*, Turn., occurs in the same locality at the same season.

### *Elis (Mesa) xanthocera*, Gerst.

*Elis (Mesa) xanthocera*, Gerst. Arch. f. Naturg. xxxvii. p. 353 (1870). ♀.

*Elis (Mesa) incerta*, Turn. Proc. Zool. Soc. London, p. 710 (1912). ♂.

I took both sexes in large numbers at Queenstown in January 1923 on *Mimosa*-blossom.

### *Elis (Mesa) capitata*, Sm.

*Myzine capitata*, Sm. Cat. Hym. B.M. iii. p. 74 (1855). ♂.

*Elis (Mesa) auriflua*, Turn. Proc. Zool. Soc. London, p. 705 (1912). ♀.

I took both sexes at Aliwal North in December 1922, and have no doubt that they belong to the same species, which has a rather wide range on the South Africa tableland.

*Elis (Mesa) longiventris*, Turn.

*Elis (Mesa) longiventris*, Turn. Proc. Zool. Soc. London, p. 712 (1912). ♂.

♀. Nigra, punctata, albo-pilosa: tergito quarto, basi infuscato, quinto sextoque, sternito tertio apice, quarto, quinto sextoque rufo-ferrugineis; alis hyalinis, venis luteo testaceis.

Long. 9-12 mm.

♀. Head and thorax strongly punctured, the punctures well separated and not confluent, the punctures sparser on the sternum; median segment much more finely and shallowly punctured; in the middle, at the base the punctures almost disappear. Abdomen not very closely punctured, the punctures larger and sparser on the sternites than on the tergites; sixth tergite rather sparsely punctured at the base, finely aciculate on the apical portion. Spines of the tibiae and tarsi whitish, basal joint of hind tarsus with a row of spines beneath.

*Hab.* Mossel Bay and Ceres; common; a single pair of small size taken at Aliwal North.

Can be taken at nearly all times of year. A variety taken at Montagu has the abdomen entirely black, excepting the brown apex of the sixth tergite. This cannot be *hottentota*, Sauss., in which the sixth tergite is striolate, and the colour of the pubescence does not agree with the short description of *capensis*, Lep.

The wings in some specimens are faintly tinged with fuscous.

*Myzine bonæspei*, sp. n.

♂. Niger; mandibulis, apice excepto, clypeo, scapo macula apicali subtus, pronoto margine anteriore angustissime, fasciaque marginis posterioris, tegulis, tergitis 5 basalibus fascia apicali integra, sexto fascia apicali lateribus emarginata, septimo maculis tribus, sternitis 3-6 fascia apicali integra, secundo septimoque maculis tribus, femoribus basi nigris, tibiis tarsisque flavis; alis hyalinis, venis fuscis, stigmatate ferrugineo.

Long. 15 mm.

♂. Pubescence white and rather long, fairly dense on the head and thorax. Antennæ long (9 mm.) as compared with the length of the costa (12.5 mm.). Antennæ, as usual in the genus, with only twelve visible joints, the first visible joint of the flagellum half as long as the third, the latter distinctly longer than the second. Pronotum somewhat narrowed anteriorly, the anterior margin almost straight and

distinctly raised. Mesonotum a little longer than the pronotum. Abdomen slender, the apical aculeus long, the apical incision of the seventh tergite broader at the apex than deep, the lateral processes narrowly produced and very narrowly rounded at the apex. Third abscissa of the radius shorter than the fourth and much shorter than the second, the third cubital cell receiving the second recurrent nervure at about one quarter from the base.

*Hab.* Spes Bona Farm on the Karroo, 38 miles east of Ceres, November 17-25, 1924.

*Myzine pacificatrix*, Cam.

*Plesia pacificatrix*, Cam. Ann. Transv. Mus. ii. p. 118 (1910). ♂.

I took males of this species both at Queenstown and Aliwal North. I consider that it will prove to be the male of *Myzine perornata*, Turn., but the evidence is as yet insufficient. Specimens of *M. perornata* taken at Queenstown in January 1923 have the basal tergites black, not suffused with ferruginous as in the type, but do not differ otherwise.

*Myzine ceresensis*, sp. n.

♀. Nigra, sparse nigro-pilosa; antennis piceis; mandibulis tarsisque fusco-ferrugineis; alis fuscis; cellula cubitali secunda obsoleta.

Long. 5 mm.

♂. Niger; albo-pilosus; mandibulis, apice excepto, pronoto fascia lata postice, tegulis 2-5 fascia apicali utrinque late interrupta, tibiis basi, tarsisque apice infumatis, pallide flavis; alis hyalinis, stigmate luteo-ferrugineo, venis fusco-ferrugineis.

Long. 5-8 mm.

♀. Mandibles bidentate at the apex; head subquadrate, smooth and shining; the clypeus finely punctured and narrowly emarginate anteriorly; interantennal tubercles strongly developed. Pronotum longer than the mesonotum and scutellum combined, nearly as long as its posterior breadth, very slightly narrowed anteriorly, smooth and shining, the anterior slope and the neck closely punctured and clothed with long black hairs. Mesonotum and scutellum smooth and shining, the scutellum with a short and shallow median groove not quite reaching the middle. Median segment rather strongly punctured, more sparsely in the middle than at the sides, with a narrow median groove which extends to the median depression on the posterior slope. Pleuræ rather sparsely punctured. Abdomen shining, with

a few very small and shallow punctures on the tergites, the punctures on the sternites larger and piliferous. Second cubital cell absent; stigma dark fuscous, situated close to the middle of the costa.

♂. Head and clypeus finely punctured, the clypeus rather strongly convex. Antennæ ( $3\frac{1}{2}$  mm.) much shorter than the costa ( $5\frac{1}{2}$  mm.). Third joint of the flagellum (second apparent joint, the first being concealed) about half as long again as the second and a little shorter than the fourth. Pronotum a little longer than the mesonotum, narrowed anteriorly, the anterior margin straight. Thorax more strongly punctured than the head; median segment rugosely punctured. Abdomen slender, the first segment beyond the petiole longer than its apical breadth, swollen and slightly constricted at the apex; second segment a little shorter than its apical breadth. Seventh tergite rather coarsely punctured, shining in the middle on the apical half, the apical incision rather shallow, broader apically than deep, the lateral processes broadly rounded at the apex. Sternites 2-5 with a small yellow apical spot and also a small spot at each apical angle. Second abscissa of the radius longer than the third, second recurrent nervure received near the middle of the third cubital cell. Cubital nervure only continued beyond the cells by an extremely short stump, discoidal nervure not continued beyond the cells.

*Hab.* Ceres, Cape Province, 1500 feet, 1 ♀ in January 1925; a long series of males from January to April.

The male is very similar to *M. swalei*, Turn., from Rhodesia, but differs in the paler colour of the stigma in the proportion of the abscissæ of the radius, which, however, is not a very constant character in the genus, and in the much more broadly rounded lateral processes of the seventh tergite, and in the less convex tergites.

### Family Psammocharidæ.

#### *Calicurgus namabataashane*, sp. n.

♀. Nigra; mandibulis, flagello tarsisque anticis brunneo-ferrugineis; alis hyalinis, anticis fusco-bifasciatis, apiceque extremo infuscatis.

Long. 7 mm.

♀. Head and thorax opaque, coriaceous; the clypeus narrowly and shortly produced at the apex, the small produced portion shining and shallowly emarginate; a row of punctures along the margin of the clypeus, from each of

which springs a pale yellowish hair; the mandibles beneath clothed with similar hairs. Second joint of the flagellum a little longer than the third, but not as long as the first and third combined. Pronotum strongly rounded anteriorly; the hind margin arched, not angulate in the middle. Median segment rounded posteriorly, with a median sulcus from base to apex, the posterior slope gradual, the segment opaque and coriaceous, not striate. Abdomen shining, the transverse groove on the second sternite well developed; sixth tergite clothed with pale yellowish hairs. Hind tibiæ serrate, their longest spur about half as long as the basal joint of the hind tarsus. Second abscissa of the radius much longer than the third, but the second cubital cell is shorter on the cubitus than the third, both the second and first transverse cubital nervures being strongly sloped inwards from the radius. Cubitella originating considerably beyond the nervellus, postfurcal. The basal fuscous band of the fore wing crosses the wing irregularly from the base of the first cubital cell; the second band occupies the basal half of the radial cell, almost the whole of the second and third cubital cells, and the apical third of the second discoidal cell.

*Hab.* Port St. Johns, Pondoland, October and December 1923; two females.

Another specimen taken at Mossel Bay in November 1921 has the anterior margin of the clypeus straight, the posterior portion of the median segment distinctly transversely striated; the fuscous bands of the fore wing are broader and the cubitella originates a little nearer to the nervellus.

This probably will prove to represent a western race of the species.

### Family Sphegidae.

#### Subfamily *Miscophinae*.

#### *Nitela henrici*, sp. n.

♀. Nigra; fronte pallide auro-piloso; mandibulis, scapo, flagello articulis duobus basalibus, pedibusque ferrugineis; alis hyalinis, venis ferrugineis; thorace crasse reticulato.

Long. 3.5–4 mm.

♀. Front opaque, rather strongly punctured, clothed with pale golden pubescence, sparsely on the upper portion, densely on the concave area round the base of the antennæ and on the clypeus. Anterior margin of the clypeus convex, the median area strongly carinate longitudinally in the middle. Vertex and occiput punctured-rugose; pronotum, mesonotum,

and scutellum very coarsely reticulate; the anterior angles of the pronotum acute, distinctly produced and pointed; pleuræ much more finely reticulate. Median segment longitudinally striate-reticulate, but less coarsely sculptured than the mesonotum, the posterior slope hollowed in the middle and finely transversely striate, the sides of the segment obliquely striated. Abdomen smooth and shining. Posterior ocelli separated from the eyes by a distance less than half of their own diameter. Hind coxæ black above.

*Hab.* Colombo, Ceylon (*G. M. Henry*), August 16, 1923.

On a bamboo bored by Scolytids. Doubtless nesting in abandoned beetle-burrows.

Most nearly related to the Australian *N. sculpturata*, Turn., but is a much smaller species; the angles of the pronotum are more strongly produced, the reticulation of the thorax is coarser and more clearly defined, the head is narrower, and the colour of the frontal pubescence different. It differs much both in colour and sculpture from the only other species of the genus I have seen from Ceylon—near *N. fallax*, Kohl,—of which there is a specimen in the British Museum taken by Mr. Rutherford at Peradeniya, as well as others from Pusa in N. India.

### XIII.—On some African *Papilios*, with Descriptions of new Forms. By LORD ROTHSCHILD, F.R.S., Ph.D.

WHEN the late Mr. Henley Grose-Smith described his *Papilio erithonioides* in vol. vii. of the Ann. & Mag. Nat. Hist. for 1891, he had two insects mixed up in his series, and described the ♂ of one and the ♀ of the other as being the sexes of his *erithonioides*. This is why in the description the ♀ is stated to be very large and to have long tails.

When arranging my African *Papilios* the other day, we found among the ♂♂ *erithonioides* a ♀ with no tails and of the same appearance as the ♂♂, while the single-tailed very large insect, received from Mr. Grose-Smith as a ♀, on examination proved to be a ♂.

Mr. Joicey very kindly lent me the ♀ type of *erithonioides*, Gr.-Sm., for comparison, and the tailed form turns out to be an undescribed species. It is very curious that, while the whole of Africa is inhabited by a single species, *Papilio demodocus*, Esp., and the whole of the Indo-Australian

region also only by a single species, *Papilio erithonius*, the island of Madagascar should be inhabited by four out of the five known species of the *erithonius-demodocus* group of *Papilio*.

*Papilio grose-smithi*, sp. n.

*Papilio erithonioides*, Gr.-Sm., ♀ nec ♂, Ann. & Mag. Nat. Hist. (6) vii. p. 122 (1891) (Madagascar).

♂. Differs from *erithonioides* by its much larger size and long tails to the hind wings. Above differs from *erithonioides* in the yellow markings in the cell of fore wing being much more coalescent and forming more distinct lines not rows of spots, and the stramineous patch between veins 2 and 3 less produced distad; between the stramineous band of patches and the submarginal row of spots the black ground-colour is much more thickly powdered with yellow scales. On the hind wing the submarginal row of spots is much larger, each spot being hoop- or staple-shaped, and between these spots and the stramineous band, instead of a scattered powdering of yellow scales, the scales are more numerous and form clouds. The apex of the fore wing is much more produced than in *erithonioides*, and the hind wing at vein 4 is produced into a tail  $\frac{3}{4}$  of an inch long, instead of merely showing a blunt tooth as in *erithonioides*.

♀. Similar, but beyond the costal ocellus on the hind wing is a red patch and a smaller one on the inner side of the ocellus. The clouding on the disc of the hind wing is thicker than in the ♂, and several ill-defined small blue half-moons are present.

Expanse, ♂ ♀, 133 mm.; length of fore wing 64 mm.

*Habitat*. N.W. Madagascar.

[♀ *erithonioides* similar to ♂, but with red outside patch to ocellus near costa of hind wing.]

*Papilio wilsoni*, sp. n.

This species of the *P. nireus* group resembles above almost exactly *P. nireus pseudonireus*, Feld., but the ♀ is very different below.

♂. Above resembles *N. pseudonireus*; below the submarginal golden band on the hind wing is composed of rounded not square spots, which in most specimens are wider apart, i. e., less coalescent.

♀. Dimorphic above, green or blue, and the green form above similar to ♀ of *n. pseudonireus*; below a submarginal band of twin golden patches on fore wing, and on the hind



wing a similar band of much larger almost lunate coalescent patches, between which and the margin are twin metallic spots between the nervures varying in number and size in the four ♀♀ examined. In the ♀ of *n. pseudonireus* these submarginal bands are entirely absent.

4 ♀♀, 38 ♂♂, Nubar Hills, Talodi, 10° 39' N., 1625 ft., July 1917-18. (Type ♀.)

3 ♀♀, 32 ♂♂ in Oxford Museum; 1 ♂, 1 ♀, paratypes, Tring, presented by Prof. Poulton.

I am keeping this form as a distinct species, but on further examination it may prove to be a local subspecies of *cyclops* or *æthiops*.

#### XIV.—On some new Species and Subspecies of *Milionia*.

By Lord ROTHSCHILD, F.R.S.

##### *Milionia completa*, sp. n.

This insect is most nearly allied to *M. euchromozona*, Prout, from New Ireland, but lacks the strong metallic-purple suffusion in the ♂, and the red band on the fore wing is narrower and bright scarlet. It differs from all others of this group in having a median scarlet band across the hind wings.

♂. Pectus and outside of legs bright metallic saphirine-blue; frons, collar, and patagia also metallic saphirine-blue; tegulæ and thorax black with strong purple sheen; abdomen black with purple sheen, the front half of each segment bright metallic saphirine-blue; abdominal tuft, basal half blackish green, apical half buff.

Fore and hind wings velvety black, glossed at base and on fringes with purple, across both wings a broad curved scarlet band with irregular distal margins. Underside of wings similar, but basal  $\frac{1}{2}$  purple strongly saturated with bright metallic saphirine-blue; the scarlet bands suffused with orange.

♀. Similar, but with more metallic-blue on abdomen; the red bands above much broader and more orange scarlet; these bands below deep orange.

Expanse, ♂ 70 mm., ♀ 74 mm.; length of fore wing, ♂ 30 mm., ♀ 32 mm.

*Hab.* Talesea, New Britain, March-April 1925 (*A. F. Eichorn coll.*) (type ♂).

Eichorn sent one very extraordinary melanic variety of this insect; I here describe it as:

*Ab. nigra*.

♂. Similar to type as regards pectus, thorax, and coxæ; but the blue on the rest of the legs and abdomen reduced in amount. All wings velvety black, a red pin-point spot above tornus of left hind wing.

*Milonia exultans*, sp. n.

This is unlike any other *Milonia* of this section.

♂ ♀. Above: pectus and fore coxæ brilliant metallic saphirine-blue, tibiæ of all legs darker metallic-blue, tarsi dark brown; frons and patagia brilliant metallic saphirine-blue; tegulæ and thorax saphirine-blue marked with purple; abdomen brilliant metallic saphirine-blue, the hind edges of the segments purple; abdominal tuft, basal half black, apical half buff. Fore wings shining bluish purple,  $\frac{1}{2}$  of costal and subcostal area metallic saphirine-blue, as is also basal  $\frac{1}{2}$  of wing, nervures blue; a crimson-scarlet oblique quadrate patch  $\frac{1}{2}$  from base runs up from inner margin almost to median vein in most specimens, but in several it is either larger and irregular, narrower and almost linear in others, and in two it is reduced to a spot. Hind wings entirely shining bluish purple, median vein broadly saphirine on basal  $\frac{2}{3}$ . Underside of both wings velvety black, glossed with purple, basal  $\frac{1}{2}$  saphirine.

Expanse, ♂ 31–35 mm., ♀ 31–34 mm.; length of fore wing. ♂ 28–32 mm., ♀ 28–32 mm.

*Hab.* Talesea, New Britain, March–April 1925 (*A. F. Eichorn coll.*) (type ♂).

*Milionea polytropa novæbritanniæ*, subsp. n.

♂. Differs from *M. p. polytropa*, black form, in the greater extent of orange on the abdomen, the first four segments being entirely orange-yellow edged posteriorly with black, and in having a large orange-yellow patch on the abdominal area of the hind wing below.

*Hab.* Talesea, New Britain, March–April 1925 (*A. F. Eichorn coll.*), 1 ♂.

*Milonia elegans reducta*, subsp. n.

♂. Differs from *M. e. elegans* above in having a more purple less greenish sheen on the fore wings, and in the white spots on outer  $\frac{1}{2}$  of those wings being much reduced; the large white oblique band is more kidney-shaped and much narrower and less square at costa and inner margin. On the hind wing the rufous patch runs to a point below

median nervure, and is wedge-shaped, not rounded. Below it differs in the yellow area of hind wing, being larger and more wedge-shaped, almost surrounding the black central patch.

*Hab.* Talesea, New Britain, March and April 1925 (A. F. Eichorn coll.), 2 ♂♂.

XV.—*A new Catfish of the Genus Cetopsis from the Rio das Velhas, Brazil.* By J. R. NORMAN.

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*Cetopsis chalmersi*, sp. n.

Depth of body  $4\frac{1}{2}$  to  $5\frac{1}{2}$  in the length, length of head  $4\frac{1}{4}$  to  $4\frac{3}{5}$ . Head somewhat longer than broad. Snout longer than eye, diameter of which is much larger than that of posterior nostril, and about  $2\frac{1}{2}$  in interorbital width. Width of mouth  $\frac{1}{2}$  to  $\frac{3}{5}$  length of head; upper jaw a little projecting. Teeth conical, in bands in the jaws, that of the lower jaw divided at the symphysis; two or three irregular series on the vomer forming a crescentic band, which is parallel with that of upper jaw. Maxillary barbel  $\frac{2}{5}$  to nearly  $\frac{1}{2}$  length of head; post-mental barbel longer than mental, about  $2\frac{1}{5}$  in length of head. Dorsal 15; origin twice or more than twice as distant from base of caudal as from end of snout; spine a little higher than first ray and nearly as long as head. Anal 22–23. Upper ray of pectoral a little produced,  $\frac{1}{2}$  to  $\frac{3}{5}$  length of head. Pelvic short, the inner edge connected by a membrane with skin of belly. Caudal peduncle about as deep as long. Yellowish brown above, with numerous blackish punctulations; silvery-white on sides and below; fins yellowish.

Three specimens, 130–140 mm. in total length, from the Rio das Velhas about 32 miles north of Bello Horizonte; collected and presented to the British Museum by Mr. G. Chalmers.

This species appears to be related to *C. occidentalis*, Steindachner, from Guayaquil, differing chiefly in the form and arrangement of the vomerine teeth and in the longer maxillary barbels.

**XVI.—Results of Hydrological Work conducted in the Region of Cape Kanin (Barentz Sea) in connection with Fisheries.**

By Dr. S. W. AVERINZEV (Institute of Fisheries, Moscow).

FIRST of all, I must make a few remarks concerning the organization of the investigations which supplied the material for this note. Their aim was an inquiry into fishing conditions in the Barentz Sea, and I conducted them in conjunction with the usual work of catching fish. I succeeded in hiring a steam-trawler (145 feet in length, with an engine of 500 H.P.), equipped with a 100- and a 110-foot trawl. The expenses connected with the conducting of fishing operations and the parallel scientific work had to be realized from the sums obtained from the sales of fish.

The captain I had with me had never up till then worked on a fishing steamer, nor did he ever occupy himself with fishing. Our work began in 1918, and, notwithstanding a great many difficulties, we succeeded in finishing the year without any loss, and were able to pay off, not only running expenses, but also organizing expenses, which included, besides, a significant sum for repairing the trawler and carrying out certain adaptations for scientific work. In the following year it was necessary to cease working, on account of financial difficulties, caused by various factors not connected with fishing.

Taking into account the whole experience derived from conducting scientific research by such methods, I must admit that it certainly involves not a few difficulties; there is no doubt that it is much easier to obtain various data, if one has at one's disposal a vessel ordained solely for research work, but it cannot also be denied that, by conducting scientific investigations simultaneously with commercially organized fishing, the former approaches practical life, which is in certain cases very important. I do not in this connection take into account those expenses which are necessary for scientific investigation, and may be considerably decreased while working on a boat used for commercial fishing.

The above-indicated organization of research imposed, naturally, certain characteristic traits on the whole work. During the investigation of hydrological conditions there was no possibility of working according to the method of hydrographical sections, but one had to determine the

temperature and the salinity of the different water-layers only at those positions where fishing with the otter-trawl was done, either with the aim of reconnoitring or in order to make a larger catch when a shoal of cod-fish or haddock was revealed.

Hence the impossibility of representing results graphically as it is usually done; it was necessary to find other means. I found nothing better than to represent the most important results on several charts, on which it was possible to place only a limited number of data. As these investigations are connected with trawl-fishing, having for its object the demersal-fish (cod-fish, haddock, plaice) of the Barentz Sea, it was necessary to note on the chart the following facts:— (1) the temperature of the layer near the bottom (in degrees Centigrade); (2) its salinity (in per cent.); (3) the quantity of marketable fish (in kilograms) which can be caught during one hour's trawling; (4) the date and month of observation. Altogether I made three cruises in the neighbourhood of the Kanin Peninsula, the results of which are represented on four charts (figs. 1-4).

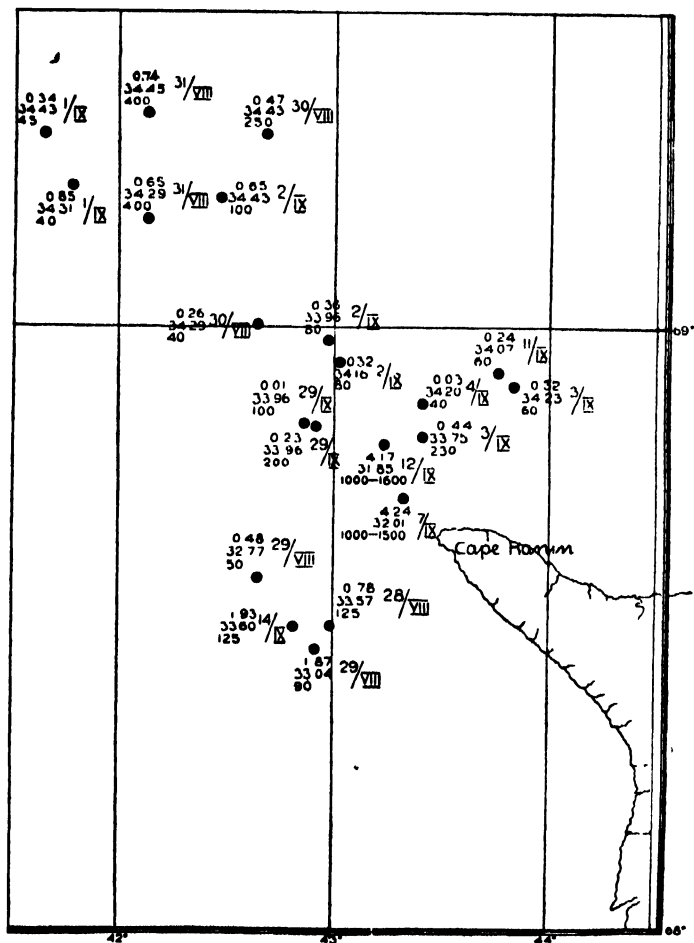
During the first voyage we were working in the Cape Kanin region from the 28/VIII. up to 14/X. Here we were, first of all, struck by the high temperature of the bottom layer of water, not far from the Cape, namely:  $4^{\circ}17-4^{\circ}24$ , with a reduced salinity of from 31.85-32.01 per cent. Samples were taken on the 7th and 12th of September, *i.e.*, with an interval of several days, which showed that such a temperature in a depth of 20-25 fathoms was retained for a fairly long time, and is not a casual occurrence.

Going from here farther towards N., N.E., and N.W., we came very quickly into an area with a greatly lowered bottom temperature. Here near the bottom, notwithstanding the time (end of August to beginning of September), the "summer," so to speak, had not as yet begun. Not far from the warm-water district we could find places where the bottom temperature equalled only  $0^{\circ}01-0^{\circ}03$ . These are the lowest temperatures at this time in this region of the Barentz Sea, as further to the N.W. and N.E. they are a little higher and lie between  $0^{\circ}34-0^{\circ}85$  and  $0^{\circ}21-0^{\circ}32$ .

Between the indicated cold-water zone (near  $0^{\circ}$ ) and the warm one (about  $4^{\circ}$ ) there is a zone with slightly warmed bottom water from  $0^{\circ}23-0^{\circ}44$ . These phenomena I ascribe to a gradual heating of the cold water under the influence of their proximity to the warmer layers. The salinity of

the water, having a temperature near 0°, is fairly high—33·96–34·20 per cent.,—which makes it also sharply different from the warm layer. Farther to the N.W. and N.E. the salinity is still increasing, and reaches up to 34·29–34·07–34·23 per cent.

**Fig. 1.**



Going towards the entrance of the White Sea, we meet higher temperatures of 0°78, 1°87, and 1°98; the salinity varies here between 38.04-38.60 per cent.

It must be admitted that the depths in this whole region

are insignificant, from 20 to 50 fathoms,—not counting, of course, the littoral region, where, in consequence of the vicinity of the coast and stony bottom, work with an otter-trawl is entirely impossible; in most cases the depth is from 30–40 fathoms.

The above description gives a picture of the temperature-conditions in near-bottom layers in the area investigated in the first half of September.

Thanks to the influx of warmer fresh water, coming evidently along close to the coast from the West side of the Kanin Peninsula, *i. e.*, from the White Sea, the temperature of the near-bottom layer in the area of Cape Kanin is much higher in comparison with the surrounding districts.

Gradually it influences the adjacent waters, inciting in them an increased temperature and reduced salinity. At this moment there begins in this area a gradual “hydrological spring,” going slowly from South to North. Let us look at the distribution of marketable fish in the bottom layer, taking into consideration the circumstance that we reckoned in only that part of the catch which has a certain market value, depending upon the species of the fish and its size.

Regions entirely devoid of fish we did not find here during all our work, notwithstanding the large quantities of fish caught; however, their quantity during this period is such that trawl-fishing is not profitable, as the otter-trawl yielded per hour from 40–400 kilograms of fish; only in the areas with a high bottom temperature did the results of the catch stand out sharply, giving from 1000–1600 kilograms and even more; at least, certain hauls gave, in the area investigated for temperature conditions, catches of 3500 and even 4500 kilograms in one hour—this also indicates that here, in a comparatively limited area, the shoals of fish are not equally distributed, wandering from place to place. We see in these examples that the use of a deep-water thermometer ought to play a large rôle in fisheries.

However, fluctuations of temperature, between 0° and 2°, had no effect on the results of the catch. It must also be noted that the condition of the fish, as regards nourishment in the warm-water district, did not differ in any way from the condition in the near-by areas. In the colder places cod-fish predominated, and in the warmer ones haddock. Is this not perhaps explained by the dimensions of the liver, as well as, mainly, by the quantity of fat in the liver of one as compared with the other of these two fish?

Cod-fish increased in quantity proportionately as the distance from Cape Kanin, especially towards N. and N.E., increased. Those points where the catches, notwithstanding the low temperature, show a significant increase in comparison with the neighbouring areas (to N.W. 40–100–400 kilograms) I am inclined to consider as indicating the course by which the haddock wends its way towards Cape Kanin. Here the latter prevails in the catches.

I wanted to determine approximately the stock of marketable fish on a ground having a high temperature near the bottom. Observations and calculations showed that we towed over with our trawler during one hour an area of 0.03 square miles. I take the relation between the size of the catch and the whole quantity of marketable fish in the area over which the trawl passed as unity—certainly this is not entirely correct; I ought to have taken a smaller dimension, but I could not unfortunately determine the same. Therefore, all figures which are based on that sort of calculation should be slightly decreased.

It must also be stated that during one voyage there were made many more trawl-hauls than are indicated on the chart, but their results have not been inserted, in order not to overload the chart with figures; work with the Nansen-Petersson Water Bottle was not done on these omitted stations.

The space occupied by warm bottom water (4°) in the given period amounts to about 30 square miles, according to my calculations, within which there can be found about 2,000,000 kilograms of marketable fish. The predominant place is here occupied by the haddock. In the whole area, about 7000 square miles adjacent to the Kanin Peninsula, there are not less than 25,000,000 kilograms of marketable fish; but the area, as a whole, is not profitable for commercially organized fishing on account of the dispersed condition of the shoals. Here we find not less than a fourth part cod-fish, nearly all the rest is haddock.

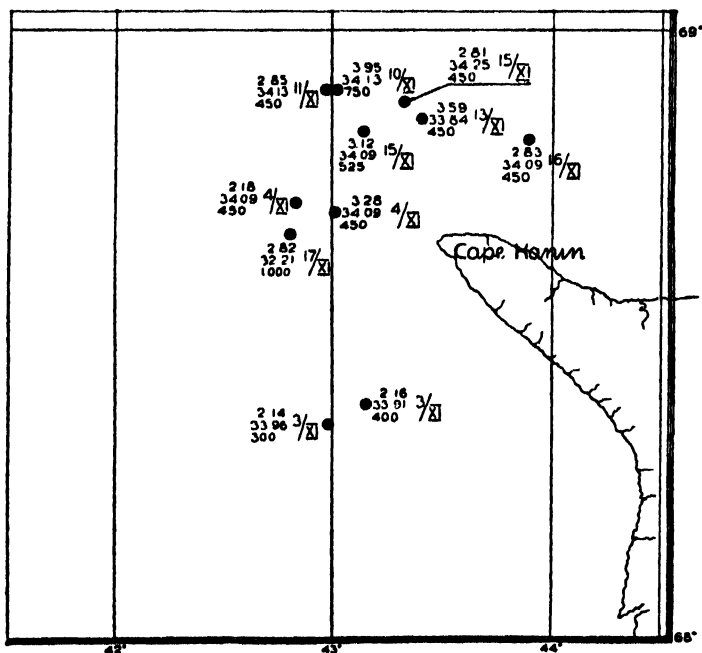
The catches made during the time while the bank is covered with warmer water, and the surrounding area keeps the same relation of temperature, remain approximately the same. The supplies of food cannot, therefore, be destroyed very rapidly, as the hydrological conditions are changing faster than that. If, however, the latter remain the same, the shoals of fish must come in continually from the colder surrounding districts into the warmer layers.

Now we will turn to an examination of data, obtained during the second voyage from the 28/IX. up to the 16th of



October. Here we will first of all see what is set down on the chart (fig. 2), *i. e.*, during the time from the 29th of September up to the 6th of October. Both in the region where  $2\frac{1}{2}$ –3 weeks before the temperature in the bottom layer was about  $4^{\circ}$ , and in the area surrounding it, which was colder on the previous occasion, we meet with temperatures from  $2^{\circ}42$ – $2^{\circ}98$ . Parallely with such temperature-changes (places with decrease and places with an increase), the salinity also changed in the vicinity of Cape Kanin to

Fig. 2.

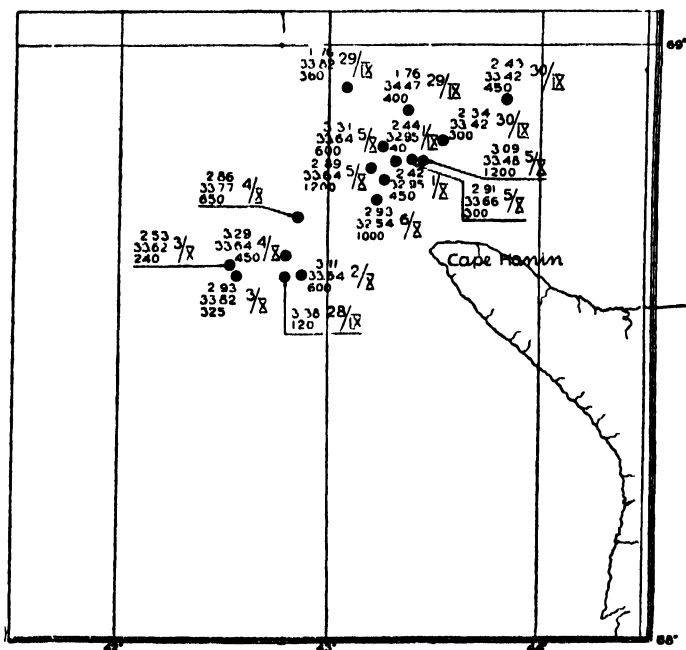


$32.93$ – $32.95$  per cent., and away from it to  $33.64$ – $33.66$  per cent., *i. e.*, we observe just the opposite concerning the increase and decrease of salinity. Further to the N. and N.E., we can also observe an increase of temperature and a lowering in salinity of the bottom layers in comparison with the conditions that prevailed earlier: to the N.  $1^{\circ}76$  and  $33.82$ – $34.47$  per cent., and to the N.E.  $2^{\circ}43$ – $3^{\circ}09$  and  $33.42$ – $33.48$  per cent. To the S.W. from the region occupied during our first voyage by a water temperature of about  $4^{\circ}$ , we also noted a considerable temperature

increase,  $2^{\circ}53-3^{\circ}38$  (salinity 33.62-33.82 per cent.). The hydrological spring came very quickly, and, as we shall see, the transition to summer is accomplished imperceptibly.

Concerning the quantity of fish caught, it is very interesting to note their general increase over the whole area; the increase of temperature results, on the one hand, in the approach of fish from other colder regions towards this locality, and, on the other hand, their shoals are distributed over a greater period. At this period there

**Fig. 3.**



were present not less than 8,000,000 kilograms of marketable fish over an area fifteen times smaller than the one in which during the first voyage there were estimated to be 25,000,000 kilograms of such fish.

The results of the work from the 9th of October up to the 16th October are represented on the chart (fig. 3).

In the region where the near-bottom temperature a week before was  $2^{\circ}89$ – $2^{\circ}98$  it equals now (*i. e.*, from the 11th to the 14th of October)  $4^{\circ}12$ – $4^{\circ}25$ —in other words, it has

increased more than  $1^{\circ}$ . Its salinity at the same time has not changed ( $32.52$ – $32.84$  per cent.).

The region occupied by bottom water above  $4^{\circ}$  has besides, in comparison with the one we have seen earlier, considerably extended. To the N. and N.W. the temperature of the near-bottom layer has also increased (from  $2^{\circ}90$ – $3^{\circ}40$ ), and its salinity has decreased; on the contrary, to the East, and particularly to the North-East, practically no changes have occurred; an extension of the warmer region is observed also in the West and South-West directions. One may even say that the short hydrological spring in the region of Cape Kanin has ended, and that the hydrological summer is beginning.

In the quantities of fish caught, haddock is still predominant, especially in the warm-water districts, but a certain increase in the quantity of cod-fish is also noticeable. Where the bottom temperature is a little higher the catches are usually also larger, but the sharp difference observed earlier between fishing-grounds, often situated quite near to one another, is not now apparent.

The fourth voyage, the results of which are marked on the chart (fig. 4), did not last long—from the 3rd of November to the 17th of November.

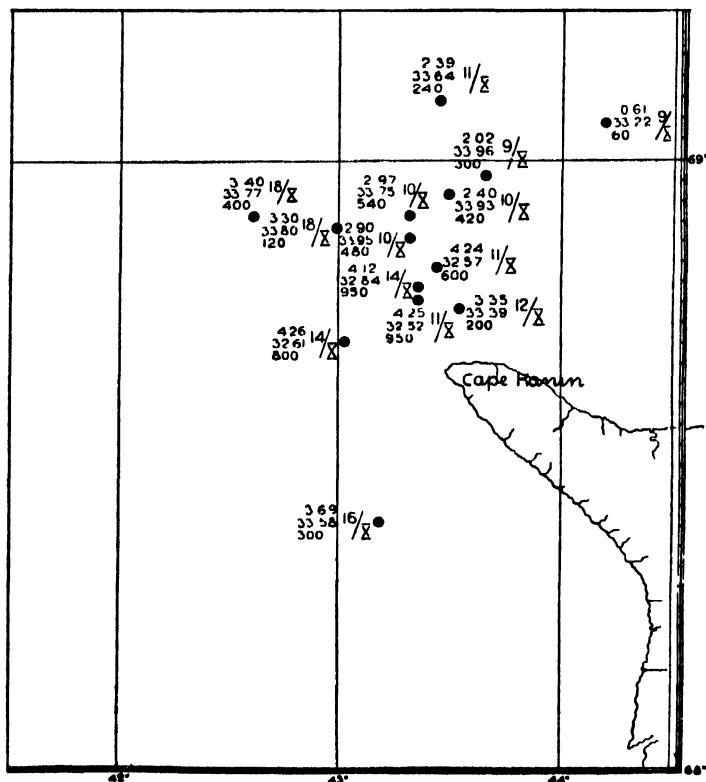
After that date, not knowing anything about the ice-conditions in the Dwinsky Bay and White Sea, and fearing to be cut off from our base, we discontinued our work.

At this time we no longer find in the neighbourhood of Cape Kanin a higher bottom temperature than  $3^{\circ}95$  (10th of November); on the following day (11th of November), nearly in the same place, the temperature equalled  $2^{\circ}85$ . In general, it must be admitted that the temperature is not high in the whole region, but it does show uniformity without the sharp fluctuations which were noted during previous voyages ( $2^{\circ}14$ – $3^{\circ}95$ ). Salinity has increased generally ( $34.9$ – $34.25$  per cent.). It is only slightly less to the South ( $33.91$ – $33.96$  per cent.).

At one point, however, approximately on the meridian of Cape Kanin, there was found a water-layer of not very high temperature, but a lowered salinity ( $32.21$  per cent.). Here, in our opinion, the hydrological summer is still continuing. If we turn to the distribution of fish, we may note that the percentage of cod-fish in the catches has greatly increased, and in places the latter predominates over haddock. The quantity of fish caught cannot be called high, but the catches are remarkably uniform over nearly the whole region. The trawl does not bring in large catches anywhere, but still

sufficient to make trawling a profitable industry. One has the impression that the shoals of haddock, which during the hydrological spring stayed in a comparatively small warmish region have dispersed all over the ground in correlation with the uniform temperature-conditions now prevailing. They have been joined by cod-fish shoals, which have assembled in this region from the North and

Fig. 4.



North-East, perhaps also on account of certain differences in the bottom temperatures.

All these data emphasize, again, the importance which hydrological and, in particular, temperature conditions have in throwing light upon the conditions of existence of marketable fish, and they indicate the possibility of applying this knowledge to practical life.

If we should try to calculate the stocks of fish of

marketable length in the region of Cape Kanin over an area of about 700 square miles, basing our calculations on the total amount of the catches, then it appears that they equal not less than 14,000,000 kilograms, *i. e.*, half of the quantity which, according to our reckoning, was distributed in the beginning of the hydrological spring over an area ten times as large.

If we should endeavour to summarize all the above-described hydrological phenomena, we can easily arrive at the conclusion that a certain pulsation may be noticed in the current of fresher and warmer water coming to the region of Cape Kanin; the temperature increases up to about  $4^{\circ}$ , then it falls, then is raised again to  $4^{\circ}$ , and falls again. The area of such warmer water is at a certain time small, at another it gets larger.

Hence the heat is transferred to other regions, thanks to the mixing of layers, which is clearly seen from the fact that the temperature increases and the salinity diminishes.

Unfortunately this work was interrupted, and could not be renewed to date, notwithstanding all efforts. The experiment of scientific research work, combined with commercial fishing, cannot be considered entirely unsuccessful; and I hope that it will yet find its application to fisheries at some future time.

#### XVII.—*The Fauna and Flora of Apple Bark.*

By S. STUART LIGHT, A.R.C.S., D.I.C., F.E.S.

THE investigation embodied in the following pages formed part of a scheme of research, undertaken, in October 1922, by means of a scholarship under the Ministry of Agriculture.

The primary object of this work was to gain an idea of the variety of insect and other life which might be injurious to the apple-tree. Particular attention was paid, in the case of the insects, to the stages in which they occur under bark and the manner in which they hibernate. With regard to the fauna, a careful study was made of the varied epiphytes occurring on the apple, with a view to obtaining further information which would assist in recording the results of their treatment with chemical sprays, in the process technically known as "bark-clearing." As far as the writer is aware, no detailed work has yet been published on bark-growths from this point of view.

In justification of the title of this paper, the complete range of fauna and flora occurring in connection with apple-bark was

reviewed, and it is hoped that the results recorded may prove to be of some interest and even, perhaps, of some technical value.

The collections were made in the Bristol district, and therefore represent the fauna and flora of that region. It must also be clearly understood that the lists appended are in no way intended to be exhaustive, but merely to give a representative idea of the nature and variety of the life of the apple-bark.

## FAUNA.

This collection falls under seven headings, as follows:—

Insecta.  
Araneida.  
Acarina.  
Myriapoda.  
Mollusca.  
Crustacea.  
Annelida.

## INSECTA.

The insects were taken mainly during the winter months, while hibernating beneath the bark. The species recorded here were those actually taken, but where other species of real economic importance occur, in connection with the bark, they are added (in brackets) separately under their respective headings. Those insects which are not found in any stage on or under the bark are omitted. Species marked with an asterisk are those recorded as pests of the apple. In many cases, for comparison, notes are appended on the occurrence of the species in other situations. The month of capture is given in brackets at the end.

## COLLEMBOLA.

### Achorutidæ.

*Lipura corticina*, Bourlet. — Black, with greenish tinge. 1-2½ mm. No springing organ. In numbers under loose bark, chiefly at fork. (Mar.)

### Entomobryidæ.

*Entomobrya annulata*, F.—Brownish yellow, black markings; banded appearance. Up to about 4 mm. Springing organ present. (Mar.)

### Sminthuridæ.

Several species.

## DERMAPTERA.

### Forficulidæ.

*Forficula auricularia*, Linn. Common Earwig.—(Nov.)

## COLEOPTERA.

Notes on occurrence refer to the general distribution; these, together with the descriptions of adults, were taken mainly from Fowler (4). When found commonly on apple by the writer, a note to that effect is added.

## Carabidæ.

*Bembidium lampros*, Hbst.—Metallic-bronze.  $2\frac{1}{2}$ – $3\frac{1}{2}$  mm. Common and universal. Fairly common on apple. (Mar.)

*Dromius agilis*, F.—Dark reddish brown.  $5\frac{1}{2}$ –6 mm. Local, but widely distributed. Also under beech-bark and among damp herbage on river-banks. (Nov.)

*D. meridionalis*, Dej.—Very much as *D. agilis*.  $5\frac{1}{2}$ –6 mm. Distributed as *A. agilis*, but more common. Common on apple. Also under beech-bark and among damp herbage. (Nov.)

*D. quadrimaculatus*, L.—Dark brown, with four large yellow patches on elytra.  $5$ – $5\frac{1}{2}$  mm. Common and widely distributed. Very common on apple. Also under bark of various trees. (Nov.)

*D. quadrinotatus*, Panz.—Very much as *D. quadrimaculatus*, but smaller.  $3\frac{1}{2}$ –4 mm. Common, but not so abundant as the last. Very common on apple. Also under bark of various trees. (Nov.)

*Dromius* sp.—Larvæ. Grey. Up to 5 or 6 mm. Actively predaceous. Live just under bark; found singly, as the adult. (Nov.)

## Staphylinidæ.

*Homalium iopterus*, Steph.—Reddish brown, black head; broadish body.  $2\frac{1}{2}$ – $2\frac{3}{4}$  mm. Local in distribution. (Feb.)

*H. vile*, Er.—Dark brown to black; broadish. 2 mm. Common and widely distributed. (Nov.)

*Homalota analis*, Grav.—Black.  $1\frac{1}{2}$ –2 mm. Narrow-bodied. Very common universally. (Feb.)

*H. melanaria*, Muls. (?).—Black, with yellow elytra. Narrow; tapering abdomen.  $3\frac{1}{2}$ – $3\frac{3}{4}$  mm. Very common. (Feb.)

*H. xanthopus*, Th.—Black, with brown elytra.  $3\frac{1}{2}$  mm. Rare. (Mar.)

*Homalota* sp.—Black, very small. (Dec.)

*Pæderus littoralis*, Gr.—Brilliant shining red, elytra blue, head and hind part of abdomen black. Narrow-bodied, large head. 7 mm. Common and universal. Found at foot of tree, in moss etc. usually. Also at roots of grasses, under stones, etc. (Mar.)

*Quedius* sp. (?).—Larva. Yellow, with brown markings. About 6 mm. (Adults of this genus are black in colour, often with brown elytra, and of medium size.) (Feb.)

*Stenus brunnipes*, Steph.—Dull black. Narrow thorax; very protruding eyes. 3–3½ mm. Very abundant. Also in moss, haystack refuse, by sweeping, etc. (Mar.)

*Tachinus laticollis*, Gr.—Black, dark brown elytra. Body broad in centre, small head. 3½–4 mm. Local, uncommon in England. (Mar.)

*T. marginellus*, F.—Very much as *T. laticollis*, but relatively narrower. 3½–4 mm. Common and universal. In moss on apple. Also in decaying fungi, dung, etc. (July.)

*Tachyporus brunneus*, F.—Reddish, shining, oval shape. 2½ mm. Commonly and generally distributed. Also in haystack refuse, hot-beds, moss, etc. (Mar.)

*T. chrysomelinus*, L.—Red, shining; black abdomen. Oval in shape. 3–3½ mm. Very abundant everywhere. On apple; found chiefly under damp bark. Also in moss. (Feb.)

*Xantholinus longiventris*, Heer.—Shining black, elytra dark brown. Very long and narrow, large head. 7 mm. Common, widely distributed. (Feb.)

### Cryptophagidæ.

*Atomaria ruficornis*, Marsh.—Dark brown to black. 1½–1¾ mm. Very common in South and Midlands. (Feb.)

*Cryptophagus acutangulus*, Gyll.—Light brown. Thorax toothed at sides. 2–2½ mm. Not common, but local. (Dec.)

### Coccinellidæ.

*Adalia bipunctata*, L. Common 2-spot Ladybird-Beetle.—Found commonly on apple (old orchard trees), especially in winter, occurring in abundance. Adults and larvæ feed on the Woolly Aphis, etc. (Nov.)

*Chilocorus bipustulatus*, L.—Pupa. Very broad and short; brown, with the appearance of tortoiseshell. (Adult shining black, with a narrow red band in centre of each elytron, consisting of three confluent spots. 2½–3½ mm. Common. Also in sandy places, by sweeping heaths, etc.) (Dec.)

### Hydrophilidæ.

*Cercyon unipunctatus*, L.—Head and thorax black, elytra yellow-brown, with dark spot in centre of each. Oval shape. Common and widely distributed. Also in dung etc. (May.)



**Cantharidæ.**

*Dasytes* sp.—Larvæ. Active, carnivorous. Greyish, with black markings. Up to about 6 mm. Common on apple, chiefly about centre of trunk. (Nov.)

*Telephorus* sp.—Larvæ. Active, olive-green, pubescent body. Up to about 8 mm. Commonly found on apple, in crevices in bark and in outer wood. (Nov.)

**Melyridæ.**

*Malachius bipustulatus*, L.—Larva. Pink, with black head and legs. About 10 mm. Taken in cavity in bark. (Adult bright metallic-green, apex of elytra red. 5–5½ mm. Very common and universal. Also on flowers and by general sweeping.) (April.)

**Anobiidæ.**

*Ptilinus pectinicornis*, L.—Brown or blackish-brown elytra; black head and scutellum. Elongate. 3–5 mm. Common and generally distributed. Found on apple, in wood-borings beneath damp bark. Also in old posts, in old willow, fir, oak, horn-beam, white-thorn, etc. (Mar.)

**Pythidæ.**

*Rhinosimus planirostris*, F.—Metallic-bronze. Distinguished from other genera by having head produced into broad flat rostrum. 2–3 mm. Common and widely distributed. Also in dead twigs, moss, etc. (Dec.)

**Mordellidæ.**

*Anaspis geoffroyi*, Mull.—Black, large yellow patch on each shoulder. 2–3 mm. Local, but not uncommon. Also on flowers etc. (Feb.)

*A. maculata*, Fourc.—Larva. White, legless. Up to 4 or 5 mm. Found in cavities in the substance of the bark and in the outer layer of wood. (Adult light brown. 2½–3 mm. Common and universal. Also on flowers and in woody excrescences on birch-trees.) (July.)

*A. (ruficollis)*, F. P.—Larvæ. White, legless. Up to 4 or 5 mm. Common on apple. Much like *A. maculata*, and found in the same situations, but more commonly—in large numbers together. (Adult black, 2½–3½ mm. Common and widely distributed. Also on flowers of whitethorn.) (Nov.)

**Lariidæ (BRUCHIDÆ).**

*Bruchus rufimanus*, Boh.—Black, with white and brown mottlings on thorax and elytra. Broad, like the weevil. 3–4 mm. Widely distributed, often common. (Mar.)

**Chrysomelidæ.**

*Lema lichenis*, Voet.—Deep blue, shining. 4–5½ mm. Common and general. Found quite frequently on apple. Also on willows, at roots of grasses, and in moss by sweeping herbage in damp places. (Nov.)

*Longitarsus suturellus*, Duft. Flea-Beetle.—Light brown, with suture between elytra outlined in black. 1¾–2 mm. Local, but not uncommon. Also by sweeping Ragwort and other plants. (Dec.)

*Phyllotreta undulata*, Kuts. Turnip Flea-Beetle.—Black, with yellow stripe on each elytron. 2–2½ mm. Generally found and common. Also on Crucifers, especially turnip. (Nov.)

*Plectroscelis concinna*, Marsh.—Metallic-bronze. 1½–2½ mm. Common and universal. Also by sweeping herbage. (Nov.)

**Curculionidæ.**

\**Anthonomus pomorum*, L. Apple-blossom Weevil.—Black, with grey V-mark on elytra. Oval body. 3–4 mm. Very common, though somewhat local. Exceedingly common on apple; often found in large numbers, in crevices of and under bark. Dead specimens attacked by a fungus frequently discovered. Serious apple-pest, laying eggs in the buds, which are later destroyed by the larvæ on hatching. (Nov.)

*A. rubi*, Hbst.—Black, with greyish pubescence, oval. 2¼–3¼ mm. Common and widely distributed. Also on various species of *Rubus* and *Rosa*, chiefly on Dog-roses and brambles. (Nov.)

*Mecinus pyrastræ*, H.—Black; elongate and cylindrical. 3–3½ mm. Found widely and abundantly. Very common on apple. (Nov.)

*Orchestes alni*, L.—Light red-brown, with four black spots on elytra. Hind femora broad, for leaping, like those of a flea-beetle. 2½–3 mm. Very common. Also on elms and by beating dead hedges. (Nov.)

*O. quercus*, L.—Reddish brown. 2½–3½ mm. Common and universal. Also on oaks. (Nov.)

**(Scolytidæ.**

\**Xyleborus dispar*. Shot-borer Beetle.—Make series of tunnels in wood beneath bark.

\**X. xylographus*, Say. Flat-celled Shot-borer.—Similar to preceding.)

**PSOCOPTERA.****Psocidæ.**

These bark Psocids probably feed on minute animals living

amongst lichens and mosses. Nymphs and adults are found, but chiefly nymphs.

*Elipsocus unipunctatus*, Mull.—Black or brown body; length  $3\frac{1}{2}$ –5 mm. Wings hyaline; expanse 12–15 mm. Common. (July.)

*Psocus bifasciatus*, Latr.—Brownish body; length  $2\frac{1}{2}$ – $3\frac{1}{2}$  mm. Expanse 10–12 mm. Common and variable. Thomson (1867) mentions it as occurring also amongst foliage of firs, yews, etc. (Nov.)

*P. fuscatus*, F.—Body yellow, with black median line on abdomen; length 3– $4\frac{1}{2}$  mm. Expanse 11– $12\frac{1}{2}$  mm. Very common on tree-trunks, including apple; difficult to distinguish against the bark, because of their coloration. (July.)

#### THYSANOPTERA.

##### TUBULIFERA.

#### Phlæothripidæ.

*Phlæothrips coriaceus*, Hahd.—Adult. Black; very long fringes on wings.  $3\frac{1}{2}$  mm. (Mar.)

*P. subtilissima*, Walker.—Adult. Black.  $1\frac{1}{2}$  mm. Walker states that they are also found in oak-galls. (Mar.)

*Trichothrips ulmi*, L.—Adult. Black; subapterous, fully winged. (Nov.)

#### TEREBRANTIA.

#### Thripidæ.

*Limothrips cerealeum*, Halid.—Adult. Black. Wingless  $1\frac{1}{2}$  mm., winged  $1\frac{1}{2}$  mm. (Nymph deep yellow.) (Nov.)

#### RHYNCHOTA.

#### Anthocoridæ.

*Anthocoris gallarum-ulmi*, De Geer.—Black and shining; hemelytra brown.  $4\frac{1}{2}$  mm. (Chiefly in the S. of England. Found (*Reuter*) also in elm-galls, and on leaves of currant and on gooseberry; also on oak. (Nov.)

*A. nemoralis*, F.—Black and shining; hemelytra brown. About 4 mm. Generally distributed. Said to feed on and to attack spiders larger than itself. Found (*Douglas & Scott*) also in tunnels of leaf-miners on oak. Butler states that they are usually taken on willow and alder. Probably common on apple. (Dec.)

*A. nemorum*, Linn. (*A. sylvestris*, L.).—Black; long antenna 4 mm. Very common and widely distributed. Found on many trees and shrubs, also on flowers. Probably common on apple. Predaceous. (Dec.)

*Lyctocoris campestris*, Fabr.—Light yellow-brown.  $3\frac{1}{2}$  mm. Habitat very varied; found in dwellings and in rubbish, as well as on trees. Very common and generally distributed. (Nov.)

*Piezostethus* sp. (?).—Nymph. Bright red. About 1 mm. (Adult black and shining. Very flat. About  $1\frac{1}{2}$ –2 mm.) Found under bark of various trees. (Dec.)

*Xylocoridea brevipennis*, Reuter. — Nymph. Black; about 2 mm. (Adult about 3 mm.) Said to inhabit hawthorn-bark. Butler (1923) records it as having been taken in Britain on three previous occasions only—in 1898, 1901, and 1919. (Feb.)

### Capsidæ.

*Ætorhinus angulatus*, Fall. —Green; elongate, long antennæ. 5 mm. Occurs on a number of trees, chiefly on elm, beech, and willow. Very common and widespread. (July.)

*Deræocoris* (*Campptobrochis*) sp.—Dark brown, shining. About 4 mm. Oval shape. Taken also by sweeping and beating limes and other trees (*Saunders*). (Mar.)

### Aphidæ.

\**Eriosoma lanigera*, Hausm. The Woolly Aphis.—Aerial form. The aerial form attacks the trunk and branches, especially at wounds, causing characteristic nodular growths (hypertrophy of the woody tissues). Exceedingly common on apple. (Dec.).

### Coccidæ.

\**Aspidiotus ostreæformis*, Curt. The Oyster-Scale.—Round scale, greyish brown; diam. 2 mm. Insects yellow to orange-yellow. Widely distributed and common. Frequently found on apple, chiefly on main trunk. Not so common as the following species. None were discovered by the writer on old orchard trees. (Jan.)

\**Lepidosaphes ulmi*, L. The Mussel-Scale.—Elongate, mussel-shaped scale. Body of insect lies at the narrow end of scale, 2–3 mm. long. Insect yellow, early nymphs white and minute. Extremely common everywhere. Found on almost every apple tree; to a much greater extent on plantation-trees free from epiphytes; few found on old moss-grown trees. (Nov.)

## NEUROPTERA.

### Hemerobiidæ.

*Boriomyia nervosa*, F.—Very like the following, but colour more variegated. Size the same. (Mar.)

*B. subnebulosa*, Steph.—Larvæ and pupæ in loose silken

cocoons. Larva greyish brown to brown, head black. (Adult dark grey—wing-expanse 14–18 mm.) One of our commonest Hemerobiids. (Jan.)

*Hemerobius* sp.—Larva. Black; very small. (Dec.)

#### LEPIDOPTERA.

Includes many larvæ and pupæ found hibernating under bark; also some moss-feeding larvæ. Adults occasionally found sheltering beneath the bark, *e. g.*, Winter Moth. Many others, such as *B. sphinx* (The Sprawler), shelter for a time on the outside of the bark, protected by their cryptic colouring, which harmonises with the bark. A number of forms occur of considerable economic importance to the apple, including the Codlin-Moth and the Winter-Moth.

#### Noctuidæ.

*Brachionycha sphinx*, Hufn.—Adult, on bark. Pale brownish grey, with black streaks. About 40 mm. Larva feeds on foliage of oak, beech, elm, ash, lime, etc. Commonly found. (Nov.)

\**Orgyia antiqua*, L. The Vapourer-Moth. — Egg-mass (hatched). Eggs brownish; on outside of cocoon. (Larvæ grey, with markings red, yellow, black, and white, and a system of tufts of hair on the back. Adult ♂ brown, with one white spot on each fore wing; ♀ wingless.) Larvæ feed on leaves in summer. Very common on apple. (Nov.)

(\**Acronycta psi*, L. Grey Trident.—Larvæ feed on leaves in summer; hibernate occasionally on trunk.)

#### Lymantriidæ.

\**Porthesia similis*, Fuess. Gold-Tail Moth.—Larva in cocoon. Black, with black and grey hairs; red stripe down centre of back; white tufts at sides. Up to about 20 mm. (Adult pure white, with end of abdomen yellow. ♀ 45 mm., ♂ 35 mm. expanse.) Larvæ feed on leaves in summer. (Dec.)

#### Notodontidæ.

\**Operophtera brumata*, Linn. Winter-Moth.—Adults. ♂ greyish-brown fore-wings, crossed by darker lines; lighter hind wings. ♀ has a mere rudiments of wings. Expanse about 22–27 mm. (Larva green, with various markings. When abundant in late spring or early summer is a serious pest in orchards, stripping the trees of their leaves.) Very common and generally distributed. (Jan.)

#### (Geometridæ.

\**Hybernica defoliaria*, Cl. Mottled Umber.—♀ ascends trunk, and is there fertilised by the ♂. Eggs laid on twigs etc., and larvæ feed on leaves.)

## (Lasiocampidæ.

\**Lasiocampa quercifolia*, Linn. Lappet-Moth.—Larvæ feed on leaves. Cocoon sometimes formed in crevices in bark.)

## Pyralidæ.

*Scoparia* sp.—Larvæ. Grey, with black markings. This is a large genus, found chiefly in temperate regions and mountainous districts of tropical countries. Larvæ feed on lichens and mosses, making galleries inside. Thus they are mildly beneficial. (Adults 15–25 mm.) Fairly commonly found on apple. (Feb.)

## (Sesiidæ.

\**Egeria myopiformis*, Bork. The Apple-Clearwing.—Larvæ make tunnels in bark beneath, and pupate in hollow cut in wood.)

## Tortricidæ.

\**Carpocapsa pomonella*, L. Codlin-Moth.—Larvæ. Pinkish colour, with greyish spots. 9–10 mm. (Adults grey-brown, with a large coppery-brown patch at end of fore wing. 14–19 mm. expanse.) Very common on apple. Larvæ often a serious pest, eating into and destroying the fruit. (Dec.)

*Exapate congelatella*, Clerck.—Pupa. Brown; about 10–12 mm. (Larva dull green.) (Nov.)

*Pammene rhediella*, Cl.—Pupa. Yellow; about 7–8 mm. (Larva found also on hawthorn.) Commonly found. (Mar.)

## (Tineidæ.

\**Hyponomeuta malinella*, Zell. Little Ermine-Moth.—Larva up to 20 mm. Grey, with black spots. Often causes serious damage to blossoms and leaves.)

## DIPTERA.

Many species of several families commonly frequent the bark, often remaining on the tree for hours at a time. These families include, notably, Chironomidæ, Mycetophilidæ, Muscidæ, Anthomyiidæ, and possibly Leptidæ. Species of Muscids and Anthomyiids have been observed (by Mr. F. G. Whitfield, of the Imperial College) to feed for protracted periods on the surface of the bark.

## Tipulidæ.

*Dicranomyia chorea*, Mg., or *Limnobia nubeculosa*, Mg.—Larva. Green; about 15 mm. (Nov.)

*Tipula* sp.—Small; frequenting bark.

**Psychodidæ.**

*Psychoda phalænoides*, Linn.—Small fly with hairy wings. 8 or 9 mm. expanse. (Larvæ live in dung and decaying vegetable matter.—‘Typical Flies,’ by E. K. Pierce, 1921.) (Nov.)

**Mycetophilidæ.**

Various small species commonly found on bark.

*Camptocladius* sp.—Small, black. (Dec.)

*Sciara* sp.—Larva. Small, white. (Feb.)

**Syrphidæ.**

Various larvæ. Grey-brown or yellow-brown, and flattish. (Dec.)

**Borboridæ.**

*Borborus* sp.—Black; 3 or 4 mm. (Dec.)

Also several species of small Schizophoran larvæ (*Musca* type), mostly in damp moss at foot of tree.

**H Y M E N O P T E R A.****Tenthredinidæ.**

*Emphytus equiseti*, Fall. (see (2), vol. i. p. 202).—Larva. Yellow, with green stripe down centre of back. About 12 mm. No cocoon formed. Feed chiefly on Rosacæ, some on oak. (Adult black, with a broad band of red on abdomen. 6-7 mm.) Larva pupated, and adult emerged, in laboratory. (Mar.)

*Empoia (Pæcilosoma) excisa*, Thoms. (see (2), vol. iv. p. 155).—Pupa. 10-12 mm. (Adult black. 6-7 mm.) (Mar.)

**Chalcididæ.**

One specimen found—a small broad species.

**Ichneumonidæ or Braconidæ.**

Two pupæ of parasitic species inside cocoons formed by larvæ of Moths.

**ARANEIDA.**

A very large number of species of spiders is found infesting the bark of old apple-trees, especially in dry areas, where it is in a flaky condition, supplying capacious accommodation for their nests and webs. On tended trees, comparatively few forms are present.

It is presumed that all are predaceous on other small animals—chiefly insects—inhabiting the bark; they are probably of no further economic importance.

Since the species observed were so numerous, and their distribution varied so much with different trees and localities, it was not thought worth while to make a detailed list of them. Great

variety in form and size occurs—from the large, flat, stoutly-built species of *Epeira* to the very small, globular, and delicate *Erigone*. Descriptions of these two examples are given below, and will serve to illustrate the diversity in type to be met with.

*Epeira* sp.—Broad and flat; stout legs. Average length 10–15 mm. Brown, with black markings. Found beneath rather damp decayed bark on old neglected trees.

*Erigone* sp.—Globular; delicate legs. Average size about 1 mm. Shining black. Found commonly in crevices in dry bark on plantation-trees during most of the year.

Other species identified were:—

*Amaurobis fenestralis*, Strom.—A small spider, with darker abdomen. (Mar.)

*Lycosa* sp. (?). —Immature specimens. (Mar.)

#### ACARINA.

Probably many different species of this order actually inhabit the bark of neglected trees, more especially those with prolific moss- and lichen-growths, but their minute size and cryptic colouring render them very difficult of detection. For this reason, and because they are of little importance economically, no list of species is included.

The great majority of the mites belong to the Oribata (vegetable feeders), and live among the varied growths of mosses and lichens, feeding on the epiphytes themselves. Comparatively few are at all conspicuous, and these are mainly species of “Red Spider” (Tetranychidæ) and red Trombidiidæ of varying size. Prof. Lefroy has informed the writer of a large red species of mite (probably *Trombidium* sp.) which occurs in abundance in some localities, laying its reddish eggs in clusters on the bark; it is probably predaceous. One of these localities is East Malling. In Feb. 1923, spraying experiments were carried out there for the removal of scale on certain trees; three rows were chosen, the outer ones being sprayed and the centre one left untreated. Ultimately, the scale continued to flourish on the treated trees, but disappeared from the untreated! The probable explanation, says Prof. Lefroy, is that, following a burst of hot weather, the mites hatched out prematurely, and effectively destroyed the scales on the centre row; on the sprayed trees, however, the mites themselves were killed off, but the scales survived.

A species of *Chamobates* (Oribata) was observed extremely commonly on the plantation-trees all the year round, being found in clusters under almost any projecting piece of bark. It is a small shining black mite, about 1 mm. long when full-grown.

Other species taken included:—

*Damæus clavipes*.—Small, black, and hairy. Slow-moving. Found singly.

*Pergamasus* sp. (?).—Small, brown; in moss at foot of tree.



## MYRIAPODA.

Species of *Julus* and *Lithobius* fairly common, under loose bark.

## MOLLUSCA.

Small species of Land-Snails, found chiefly at or around the fork of the tree, where the bark is broken up to form deep crevices.

All belong to the sub-order Stylommatopora.

*Balia perversa*.—Elongate, cone-shaped; brown. Rounded whorls. 3-4 mm. in length. Very common form.

*Clausilia biventata*.—Elongate, cigar-shaped; grey-brown. Flattened whorls. About 10 mm. in length.

*Helix hispida*.—Round, flattened; brown. Rounded whorls. 7-8 mm. long. Common on apple.

## CRUSTACEA.

Various species of Woodlice, found mainly beneath loose, rather decayed bark—in numbers where damp occurs.

## ANNELIDA.

A small immature Oligochæte, like an Earthworm. Not sufficiently developed to be further identifiable. Under decayed bark.

## FLORA.

The flora comprised the following:—

Lichens.

Liverworts.

Algæ.

Higher Plants.

Fungi were omitted, as being too minute and difficult of detection.

Of the above, the first two occur in almost equal abundance. Algæ are present, at least to some extent, on every tree of any age, whether neglected or properly cultivated, and are found in great abundance in the case of old orchard trees, forming the characteristic green coating on the bark. Liverworts, of which only two species were taken, occur frequently, but usually in small quantity—though in one orchard, at least, many of the trees bore large patches in such quantity as to almost equal the amount of lichens present.

The general tendency of all growths is to occur on the leeward side of the tree, and on the upper side of the branches—the reason

for this being that they dislike a strong wind, and favour the upper side, so as to obtain as much light as possible for the carrying on of photo-synthesis. When the trunk is inclined at an angle to the earth, as is often the case in orchards where the ground slopes, or where there is a strong prevailing wind, the growths are found on the upper side; but since they also tend to occur, as already stated, on the leeward side, a balance is sometimes reached, especially where the slope of the tree is not greatly pronounced, and the growths then occur in about equal quantity on both sides.

Broadly speaking, lichens grow on the upper part of the trunk and lower part of the branches, and mosses at the foot and at the main fork of the tree.

A factor contributing to the deterioration of orchard-trees and the growth of epiphytes is a condition of permanent dampness, which may be due to the following causes:—

- (a) Orchard lying in a hollow.
- (b) Soil badly drained.
- (c) Proximity to some body of water.
- (d) Long grass and other vegetation growing in orchard.

The first three causes explain themselves; in the case of the last, long thick vegetation tends to catch such rain as falls and to keep the ground in a marshy state, which is added to by the rotting of the undergrowth.

Any one of these factors alone tends to produce dampness in an orchard, but frequently several occur together and in some very bad cases all the conditions may be present. Here, of course, a state of rottenness is almost inevitably produced sooner or later. Then, in the case of many trees, the active inner tissue (phellogen) producing new bark is killed, and the old bark will be found as a dead covering to the trunk, which may be stripped off in large pieces. Beneath this may be discovered large numbers of woodlice of several species, certain varieties of spiders, centipedes, and sometimes earthworms or allied species. These feed to a large extent on the rotted outer layer of wood. On this damp, dead bark lichens, especially crustaceous forms, may be found in small quantity; but where much moisture is present, the growth of mosses becomes abundant, especially at the foot, where they may also extend for some distance from the tree over the roots. Usually an accumulation of soil is found on the tree itself, forming a substratum to the growths, so that they naturally tend to flourish more luxuriantly there than on other parts of the tree.

In giving a general description of the flora found on the apple-tree it would be best, probably, to take an average example of a moderately growth-covered orchard-tree in an average situation—i. e., not too damp or too much exposed to wind,—and describe the flora to be found on it.

The most conspicuous epiphyte, from a distance, is the grey-green foliose lichen, *Evernia prunastri*, occurring on the tree

from the lower part of the branches to near the foot, being in greatest profusion on the upper half of the trunk. Occupying much the same position, but in smaller quantities, dotted here and there, can be seen patches of *Parmelia fuliginosa*, resembling the foregoing in appearance, but of a dull olive-green colour, rendering it difficult to detect against the bark. A small patch or two of the liverwort *Frullania dilatata*, in appearance like a somewhat scorched moss, with its greenish to brown colouring, is probably present near the middle of the trunk. In this region, too, are found little tufts of various mosses, such as *Bryum capillare*, of a bright green colour, with broadish distinct stems, and *Zygodon conoideus* (dark green stems with small stellate heads), also such lichens as *Xanthoria parietina* (a bright yellow, compact, foliose form—green in the shade—with yellow cup-shaped fructifications) and *Buellia canescens* (much like *E. prunastri*, but pale whitish-green in colour). At the main fork of the tree various mosses are found, commonly including *Hypnum cupressiforme*, a moss with frequently a rather dull brownish tint, having narrow feathery stems which, in a variety of the species, are considerably broader. Towards the foot of the tree, the prevailing growths are crustaceous lichens, of which by far the commonest are species of *Pertusaria*, the broad white patches giving the tree the appearance, from a distance, of being mildewed. At the foot itself, mosses are always found, extending to a greater or less height up the tree—usually from 2 to 8 inches. One of the commonest of these is *Hypnum cupressiforme*—generally the narrow-stemmed form. On trees where mosses have grown for some time, the latter tend to become dried and yellow-brown in colour.

It must be understood that the above is the description of an average tree only, and allowances must be made for varying conditions—atmospheric changes, soil, altitude, age and health of tree, etc.

*Evernia prunastri* may cover the entire tree, growing out into foliose clumps, so as to follow each new growth of the tree, almost as it is formed. Mosses, too, may accompany *Evernia*, and form a thick pile spreading over the surface of the bark, continuous from the foot of the trunk to the fork. Crustaceous lichens may grow up to the lower regions of the branches (though they were not observed by the writer to traverse the branches to any height). In damp situations, liverworts may increase to large patches, occupying a considerable area of the trunk.

On the nearly horizontal branches of some plantation-trees, where the rain as it fell accumulated on the under surface, algæ were discovered to be present in greater abundance there than on the upper surface, contrary to expectation.

On some trees but slightly affected by epiphytes may be found only a few patches of *Evernia*, a little *Pertusaria*, and a slight growth of moss at the foot; these are present in the case of nearly every orchard-tree.

Trees are frequently met with in orchards which have been blown down by the wind or bent over in some other way, so that part at least of the trunk rests on the ground. On such parts there is usually a prolific growth of lichens and mosses, especially the latter, of which many species may be found not present in normal conditions, due to the unusual moisture from the ground beneath and the grass surrounding the trunk at the sides: *Dicranum scoparium*, a moss with large stems 3 or 4 inches long, is found in such a situation, and the semi-fruticose lichen *Cladonia pyxidata* is commonly seen thus.

In the case of some young trees, which bore partially-healed wounds exposing the wood, young lichens were found round the edges of the wound and on the wood, though nowhere else on the tree.

On one occasion, a white mass of crustaceous lichen in an early stage of development was seen overspreading and apparently killing off a patch of moss on the trunk of a tree bearing rather prolific growths.

By observation it was found that, on the average, the growths occur in roughly the following proportions :

<i>Erernia</i> .....	50 per cent.
<i>Hypnum</i> .....	22 " "
<i>Pertusaria</i> .....	19 " "
<i>Parmelia</i> .....	5 " "
<i>Frullania</i> .....	2 " "
Green Mosses .....	2 " "

"*Hypnum*" includes those mosses of the *Hypnum* type: rather dry and somewhat yellowish.

"Green Mosses" include such forms as *Zygodon*, *Dicranoweisia*, etc., which are usually bright green and fresh in appearance.

The appended lists of epiphytes include a short general description of each, followed by a note on the occurrence on trees in general; the latter is inserted for comparison with the distribution as confined to apple-trees in particular, which is given last.

Abbreviations used are as follow:—

*Hab.* = Occurrence on trees in general.

*Dist.* = Distribution on apple-tree.

*Sit.* = Usual situation on apple-tree.

*F.* = Fruiting-season.

Descriptions of Lichens were taken largely from Miss A. L. Smith's 'British Lichens' (12), and those of the Mosses from Dixon and Jameson's 'British Mosses' (3).

## LICHENS.

These have been divided, for identification-purposes, into three groups:—

A. Foliose. Leafy spreading forms, one- or many-lobed; under surface attached to the substratum.

B. Fruticose. Shrub-like branching forms, with a narrow attachment to the substratum.

C. Crustaceous. Spread over the substratum as a thin, very closely adherent crust.

This classification will be adhered to in the list of species; at the same time, however, they will be placed in the order of their families, according to Miss Smith's 'Manual of Lichens.'

These types overlap to a large extent, so that strict classification in this way is impossible. Gradations may occur in three different cases:—

1. In various stages of life-history. (For instance, the lichen may be crustaceous in form when young, gradually becoming foliose as it grows older.)
2. In different localities and conditions of environment.
3. In different regions of the same tree.

In foliose forms the upper surface is a cortex, formed of fungal hyphæ; the algæ constitute a gonidial layer in the centre, while the lower surface is again formed of hyphæ, with rhizoids for attachment.

Fruticose lichens are radially constructed, the cortex and centre being composed of hyphæ, with an algal layer between.

The structure of the crustaceous forms is much the same as that of the foliose, but the crust is extremely thin in places, consisting then merely of mixed algal and fungal elements. This tends to occur at the newly-formed edges of a growing patch of lichen. They are commonly found in patches, with a radial growth, the centre being the oldest and thickest part, thinning out to the edges. In species like *Pertusaria* darkening often seems to occur with age, so that the patch seems to present the appearance of concentric rings, graduating in colour from dark green in the centre to white on the outside.

## LICHENS.

### FOLIOSE.

#### Parmeliaceæ.

*Parmelia caperata*, Ach.—Thallus lobate, 3 or 4 cm. in diam. on average. Yellowish green.

*Hab.* On trunks of old trees; general and fairly abundant.

*Hist.* Not very common or abundant.

*Sit.* Usually on upper region of trunk.

*P. dubia*, Tayl.—Lobate thallus, whitish green, 3 or 4 cm. in diam. Soredia present.

*Hab.* Trunks of old trees; general in S. and W.

*Dist.* Not very common.

*Sit.* Usually towards upper part of trunk.

*P. fuliginosa*, Nyl.—Thallus lobate, olivaceous, brown or dark green; 2 to 4 cm. diam. on average.

*Hab.* On trees; general, though not common.

*Dist.* Found very commonly, but usually not very abundant or massed together.

*Sit.* Generally all over tree, and mostly on upper region of trunk.

*P. fuliginosa* (var. *lativirens*, Nyl.).—In appearance as the last, but lighter in colour.

*Hab.* On old trees; not uncommon.

*Dist.* Less common than the normal form.

*Sit.* As the normal form.

### Usneaceæ.

*Evernia prunastri*, Ach.—Greenish grey, lobate thallus, usually flat and spreading, tending, where abundant, to become strap-shaped in places. Younger portions distinct, fresher and greener in appearance. Average diam. 3–5 cm.

*Hab.* Trunks and branches of trees; general and usually abundant.

*Dist.* Very common and abundant.

*Sit.* All over trunk; in extreme cases spreads to very ends of branches.

### Physciaceæ.

*Physcia hispida*, Tuckerman.—Thallus with narrow compact lobes, grey-green, with yellow soredia; 2 or 3 cm. diam.

*Hab.* On trees; common.

*Dist.* Fairly common.

*Sit.* Usually on middle or upper part of trunk; often forms masses.

*Xanthoria parietina*, Th. Fr. (Normal form).—Lobate thallus bright yellow; generally small, 2 or 3 cm. diam.

*Hab.* On trees; general and abundant.

*Dist.* Fairly common, though in small quantity usually.

*Sit.* About middle of trunk.

*X. parietina* (form which grows in shade).—As last, but green instead of yellow.

### FRUTICOSE.

#### Usneaceæ.

*Ramalina fastigiata*, Ach.—Erect compact thallus, greyish green.

*Hab.* On trees in wooded districts; general and common.

*Dist.* Not very common.

*R. fraxinea*, Ach.—Long, branching, strap-like thallus, greyish green; up to 3 or 4 inches long.

*Hab.* On trees in open places or in forests; general and rather common.

*Dist.* Probably fairly common on trees well covered with growths.

*Sit.* High up on trunk and on branches.

### Cladoniaceæ.

*Cladonia pyxidata*, Hoffm. — Basal portion of thallus finely lobate. From thallus spring upright funnel-shaped growths, bearing the fructifications. Greyish in colour.

*Hab.* About roots of trees; general and common.

*Dist.* Rather common.

*Sit.* At base of trunk or on fallen trunks.

*Cladonia* sp. (probably *C. cerricornis*, Schaer.).—Very like above in appearance, but somewhat lighter.

*Dist.* Not so common as last.

*Sit.* As last; often found growing in the midst of moss.

### CRUSTACEOUS.

#### Lecanoraceæ.

*Lecanora conizea*, Nyl.—Rather thick thallus, generally cracked, pale yellowish green.

*Hab.* On bark of old trees.

#### Pertusariaceæ.

*Pertusaria* sp.—Thallus crustaceous; whitish or cream-coloured masses, often cracked in places. Conspicuously seen infesting apple-trees.

*Dist.* Extremely common universally.

*Sit.* All over trunk, rather inclined to the lower part; occasionally on lower portions of branches.

#### Lecidiaceæ.

*Buellia canescens*, De Not.—Thallus appears as a white patch on the bark. Soredia occur towards the centre, apothecia (when present) as black spots on the thallus.

*Hab.* On old trees; common.

*Dist.* Probably common.

*Sit.* Chiefly on upper and central parts of trunk.

*B. myriocarpa*, Mudd.—Thallus as last, but granular and sometimes evanescent. Apothecia as minute spots.

*Hab.* On trees; frequent.

### MOSSES.

For classification these are divided broadly into :—

1. Sphagnales. Peat Mosses. Differ greatly from the rest.
2. Andreales. A few species in which, among other distinctions

from the next group, the capsule when ripe opens by even longitudinal slits.

3. Bryales. Includes practically all forms known commonly as Mosses. The capsule here opens by irregular splitting.

All the species listed below belong to the last-named group.

**Nematodontæ.** Teeth of peristome solid, not transversely barred.

#### **Polytrichacæ.**

*Catharinea undulata*, Web. & Mohr.—Dull green, in loose patches. In open, dry and yellowish. Easily recognizable. Stems 1-2 in. high. Leaves small below, above very long and lingulate. Fr. late autumn and winter.

*Hab.* Occurs in woods; very common.

*Dist.* Not very common.

**Arthrodontæ.**—Teeth of peristome thin and transversely barred.

#### **Dicranacæ.**

*Dicranoweisia cirrhata*, Lindb.—Soft, dull or yellowish green. Close tufts or cushions, about 1 in. high. Leaves linear and lanceolate. Fr. winter.

*Hab.* On trees, fences, and thatch, sometimes rocks; common.

*Dist.* Commonly found.

*Sit.* Chiefly at foot; also in fork.

*Dicranum scoparium*, Hedw.—Deep green or yellowish; occurs in tufts. Leaves very long (3 or 4 in.) and falcate. Fr. late summer.

*Dist.* Not very common.

#### **Grimmiacæ.**

*Grimmia pulvinata*, Smith.—Small dense cushions,  $\frac{1}{2}$  in. to 1 in. high; whitish on surface from the hairy points of the leaves. Leaves oblong-lanceolate. Fr. spring.

*Dist.* Not very common, small bunches.

*Sit.* Near centre of trunk.

#### **Tortulacæ.**

*Tortula lævipila*, Schwaegr. (var. *lævipiliformis*, Limpr.). Deep or bright green tufts (red below) of varying size,  $\frac{1}{2}$  in. to 1 in. high. Stems branched, leaves ovate or oblong. Fr. summer.

*Hab.* Common on trunks of trees, mostly in south.

*Sit.* Anywhere on trunk and sometimes on branches.

*Barbula rubella*, Mitt.—Large soft patches, deep green above, light rust-red below. Stems slender and branched; leaves narrow and lanceolate. Fr. autumn.

*Zygodon conoideus*, Hook. & Tayl.—Small, bright green  
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cushions or patches,  $\frac{1}{4}$ –1 in. high. Leaves oblong-lanceolate, almost straight. Fr. early summer.

*Hab.* Rare on trees.

*Dist.* Not very common.

*Sit.* Towards centre of trunk.

*Z. viridissimus*, R. Br.—As *Z. conoideus*, but less slender and leaves larger. Fr. early summer.

*Hab.* Common on trees.

*Dist.* Fairly common; small clumps.

*Sit.* Towards foot.

### Orthotrichaceæ.

*Orthotrichum affine*, Schrad.—Small, loose, dull green tufts. Leaves broadly oblong-lanceolate. Fr. summer.

*Hab.* Trees; very common.

*Dist.* Fairly common.

*Sit.* Anywhere on trunk.

*O. diaphanum*, Schrad.—Small dense cushions,  $\frac{1}{2}$  in. high, greyish green. Leaves oblong-lanceolate; long hair-point. Fr. summer.

*Hab.* Trunks of trees; common.

*Sit.* Anywhere on trunk.

### Bryaceæ.

*Bryum capillare*, L.—Soft tufts, densely or loosely composed; deep green, reddish below;  $\frac{1}{2}$ –2 in. high, leaves wide, ovate-spatulate. Fr. summer.

*Hab.* Tree-trunks; abundant.

*Dist.* Rather common.

*Sit.* Generally towards centre of trunk.

### Leucodontaceæ.

*Leucodon sciuroides*, Schwaegr.—Dark green, slender primary stems, giving off secondary branches; 1–2 in. long. Leaves cordate-ovate. Fr. spring. Very rare.

*Hab.* Trunks of trees.

*Dist.* Common.

*Sit.* Lower half of trunk.

### Leskaceæ.

*Leptodon smithii*, Mohr.—Large flat patches, bright green; 1–2 in. high. Leaves cordate-ovate. Fr. spring. Rather rare.

*Hab.* Trees.

### Hypnaceæ.

*Camptothecium sericeum*, Kindb.—Wide bright or yellow-green patches. Leaves large, triangular-lanceolate. Fr. spring.

*Hab.* Trunks of trees.

*Sit.* Lower half of trunk.

*Brachythecium velutinum*, Br. & Sch.—Dense low tufts, silky, and light or yellow-green. Slender stems; leaves small, narrow, ovate-lanceolate.

*Hab.* Roots of trees; very common.

*Sit.* Lower half of trunk.

*Amblystegium serpens*, Br. & Sch.—Soft, low, dull or yellow green tufts. Slender stems; leaves small and ovate-lanceolate. Fr. spring.

*Hab.* Decaying wood; common.

*Sit.* Lower half of trunk.

*Hypnum cupressiforme*, L.—Stems rather robust, 2–4 in. in height. Tufts greyish, yellowish, or brownish green; leaves oblong-lanceolate. Fr. winter and spring.

*Hab.* Trunks of trees.

*Dist.* Very common.

*Sit.* Usually at foot of trunk; sometimes at fork.

*H. cupressiforme* (var. *resupinatum*, Schimp.).—Stems slender, pale or yellowish green usually. Rest as last.

## LIVERWORTS.

The tendency of liverworts is to choose damp situations for their growth, and thus few species are met with on the exposed trunks of trees. But *Frullania dilatata* and probably other species of the genus are frequently seen on apple-trees, and in very damp situations may occur abundantly.

Liverworts may be divided into groups:—

1. Thallose or Frondose. Superficially resembling Lichens.
2. Foliose. Superficially resembling Mosses.

Only two species in all were taken; both belong to the Foliose group and to the order Jungernanniales.

*Lophocolia heterophylla*, Schr.—Stems  $\frac{1}{2}$ – $\frac{3}{4}$  in. long; in small loose patches, frequently growing amongst moss, pale green. Leaves oblong-quadrate. Fr. early spring.

*Hab.* On trunks.

*Dist.* Not common.

*Sit.* On trunk.

*Frullania dilatata*, Dumort.—Stems  $\frac{3}{4}$  in. long, creeping, dark green to purplish brown. In dense patches. Leaves round in shape, in two rows, alternate. Fr. winter.

*Hab.* Trunks of trees; common.

*Dist.* Common, sometimes very abundant.

*Sit.* Usually towards middle of trunk.

## ALGÆ.

The algae found on the apple-tree belong entirely to the group of the Green Alga, or Chlorophyceæ, and are confined to the family Protococcaceæ.

Several species occur on the trees, of which by far the commonest is *Protococcus viridis*, Ag. (*Pleurococcus vulgaris*), found as a green incrustation on tree-trunks, palings, and other situations. *Chlorella* undoubtedly occurs, too, since it takes part in the formation of certain tree-growing Lichens.

The Algaæ favouring moisture tend to occur on the damp side of the tree, which is usually the windward side, and in this respect they differ in habit from the other growths. On horizontal branches, where the rain in falling accumulates in drops on the underside of the branch, the Algaæ frequently gather there in a thick growth in preference to the lighter upper side.

## HIGHER PLANTS.

The Mistletoe is too well-known to need further reference, and Ivy, of course, is occasionally met with, twined round the trunk of an apple-tree, but that numerous other plants, not usually associated with such a habit, on occasion also grow on the apple is not so generally known.

The following curious collection of Higher Plants was observed on various old apple-trees in the Bristol district:

Polypody Fern (*Polypodium vulgare*).

Seedling Yew-Trees (*Taxus baccata*). A few inches high.

Gooseberry Bush (*Ribes grossularia*). 2 ft. high, bearing fruit on old branch dying off.

Young Gooseberry a few inches in height.

Strawberry Plant (*Fragaria vesca*) in bloom; almost normal growth.

† Wild Strawberry (*Fragaria vesca*). Plants on top of horizontal branch 8 ft. from ground, growing from clefts. in fork, etc.

Burdock (*Achæa lappa*). 18 inches high; normal growth.

† Germander Speedwell (*Veronica chamaedris*). Large clump in full bloom.

† Ragwort (*Senecio jacobæa*). Two large roots.

† Marsh-Thistle (*Cardus palustris*). Root running up to bloom.

My thanks are due to various members of the Entomological Department of the British Museum for the identification of insects—particularly to Mr. K. G. Blair and Mr. F. Laing, and to Miss A. Lorrain Smith and Mr. A. Gepp, of the Botanical Department, for identification of flora. Further, I am indebted to Mr. C. E. Tutin, of Long Ashton Agricultural Research Station, for information regarding the Higher Plants.

† At top of hill, getting mist when clouds are low.

## REFERENCES.

- (1) BUTLER, K. A. (1923). 'A Biology of the Hemiptera Heteroptera.'
- (2) CAMERON, P. (1882). 'Monograph of the British Phytophagous Hymenoptera.' Ray Soc.
- (3) DIXON, H. N., and JAMESON, H. G. (1904). 'Student's Handbook of British Mosses.' Ray Soc. 2nd edition.
- (4) FOWLER, W. W. (1887). 'Coleoptera of the British Islands.'
- (5) HIRST, S. (1920). "Revision of the English Species of Red Spider." Proc. Zool. Soc. London, July 1920.
- (6) LEFROY, H. M. (1915). "On keeping Orchards clean." J. R. Hort. Soc., Aug. 1915.
- (7) MACVICAR, S. M. (1912). 'Student's Handbook of British Hepaticae.'
- (8) MEYRICK, E. (1895). 'Handbook of British Lepidoptera.'
- (9) MICHAEL, A. D. (1883). 'Monograph of British Oribatida.' Ray. Soc.
- (10) NEWSTEAD, R. (1901). 'Monograph of the Coccidae of the British Isles.' Ray Soc.
- (11) SAUNDERS, E. (1892). 'The Hemiptera Heteroptera of the British Islands.'
- (12) SMITH, A. L. (1918). 'British Lichens.' British Museum.
- (13) THEOBALD, F. V. (1909). 'Insect Pests of Fruit.'
- (14) WITHERCOMBE, C. L. (1925). "Some Aspects of the Biology and Morphology of the Neuroptera." Tr. Ent. Soc. Lond., Feb. 1925.

XVIII.—*The Genus Corwenia*, gen. nov. By STANLEY SMITH, M.A., D.Sc., F.G.S., and T. A. RYDER, B.Sc.

[Plates V. & VI.]

THE name *Corwenia* is here proposed for species of Rugose corals which have essentially the same internal structures as *Dibunophyllum*, but which are compound. Two species only are known to us, *Corwenia rugosa* (M'Coy) and *Corwenia vaga*, sp. n. Both these occur as phaceloid (fasciculate) colonies, and resemble externally the fasciculate forms of *Lonsdalia* or the larger *Lithostrotion*.

Both species are of Viséan age, and are undoubtedly related genetically to species of *Dibunophyllum*—*Corwenia rugosa* more closely so, perhaps, than *Corwenia vaga*. *Corwenia rugosa* is a comparatively stable species, whose individual corallites vary from one another only in small details. *Corwenia vaga*, on the contrary, is an exceedingly unstable form, and affords a useful study of the variability possible within a single species—in fact, within the corallite itself.

In addition to the two species of *Corwenia*, a third species is described, also a compound phaceloid coral, and one in which a similar axial structure—a central column of the *Dibunophyllum* type—is developed, but which in its other

characters suggests a very different lineage, and which may be of an entirely different age.

We tender our thanks most cordially to all those who have generously placed at our disposal the material here described, and have supplied us with the necessary stratigraphical details, as well as to Dr. W. D. Lang for helpful criticism and to Mr. J. W. Tutchcr for the great care he has taken in the photography. The letter R. followed by a number indicates the register-number of a specimen in the British Museum.

### CORWENIA, gen. nov.

*Etymology.* Corwen in Merionethshire, the type-locality of *Corwenia rugosa*.

*Diagnosis of Genus.* Compound Rugose Corals, which possess to a greater or lesser degree the internal characters of *Dibunophyllum*, Nicholson & Thomson.

Genoholotype. *Lonsdaleia rugosa*, M'Coy.

#### *Corwenia rugosa* (M'Coy). (Pl. V. figs. 1-5.)

1840. *Lonsdaleia rugosa*, F. M'Coy, Ann. & Mag. Nat. Hist. ser. 2, vol. iii. p. 13.

1851. *Lonsdaleia rugosa*, F. M'Coy, Brit. Palæoz. Foss. p. 105, pl. iii. B. figs. 6, 6a c. In this the original description of 1840 is repeated, with the addition of excellent figures.

1916. *Dibunophyllum rugosum*, S. Smith, Quart. Journ. Geol. Soc. vol. lxxi. (for 1915) pp. 264-268, pl. xxi. figs. 3-16. The holotype is redescribed from thin sections, and a full synonymy and digest of the literature is given.

*Holotype.* Sedgwick Museum, Cambridge. (No. 48) Hafod-y-Caleh, Corwen. Figured by F. M'Coy, 1851, pl. iii. B. fig. 6, and by S. Smith, 1916, Q. J. G. S. vol. lxxi. pl. xxi. fig. 3.

The type consists of four pieces of coral, which are described in detail in the Q. J. G. S. vol. lxxi. p. 264.

*Description.—External Characters.* The colony is phaceloid, and grows to considerable size—coral-growths of a foot or two in height and several feet in extent are not rare. The corallites are cylindrical and erect. In the more typical forms of the species the corallites measure from 10-15 mm. in diameter, but are subject to marked irregularities of growth (of the nature of rejuvenescence). Thus the form externally resembles *Lonsdaleia duplicata* (Q. J. G. S. vol. lxxi. pl. xxi. fig. 3). A smaller variant is common in the Carboniferous rocks of Carnarvonshire near the Menai Straits, in which the corallites reach a length of several inches without branching, and maintain throughout

a fairly uniform diameter of 7.5 mm., or even less. This type has a strong superficial resemblance to *Lithostrotion martini* (Pl. V. fig. 1). The calice is typically shallow, with a gently sloping floor, and a prominent boss—the distal termination of the central column—occupying the intra-theal depression (see Q. J. G. S. vol. lxxi. p. 266, and pl. xvi. fig. 4).

*Internal Characters.* Transverse Section. Pl. V. figs. 2 & 3 (Q. J. G. S. vol. lxxi. pl. xxi. figs. 5, 7, 12, 16).

Longitudinal Section. Pl. V. figs. 4 & 5 (Q. J. G. S. vol. lxxi. pl. xxi. figs. 6 & 15).

In its structural details *Corwenia rugosa* agrees closely with the earlier and less specialized forms of *Dibunophyllum*. It has:—

1. A central column of the *Dibunophyllum* type, *i. e.*, one built up of arched tabellæ, intersected by a few septal lamellæ only, but completely bisected by a medial plate.

2. A medial (tabular) zone of tabellæ of the same character as those in the central column.

3. An outer (extrathecal) zone of dissepiments.

The major septa usually extend from the epitheca to the central column\*, and a few of them may actually enter this and continue to the medial plate as septal lamellæ. In the holotype they number forty, but in the small variant from Bangor less than thirty. The minor septa are feebly developed. A cardinal fossula is generally recognizable, but is usually inconspicuous in the mature corallite.

The septa are of fairly uniform thickness throughout their entire length, though they may become somewhat attenuated and flexed near the periphery. In no case yet observed do they show that secondary thickening in the cardinal quadrants which is so often seen in *Dibunophyllum* and other simple Clisiophyllids, and only rarely do they break away from the epitheca, as they commonly do in *Corwenia vaga*.

The septal lamellæ are few in number, usually about eight, and for the most part are separated from the septa. The medial plate is in most cases straight and distinct, and completely bisects the central column; but is never excessively thickened.

The tabellæ within the central column do not differ in character from those in the surrounding medial zone. In both cases they are small, convex, and distally curved; but

\* A case in which most of the septa terminate axially before reaching the central column is figured in the Q. J. G. S. vol. lxxi. pl. xxi. fig. 12. This feature (characteristic of *Dibunophyllum*) is unusual in *Corwenia*.

in the former they are more numerous and crowded, and more steeply inclined.

The central column is, in a well-developed specimen, clearly marked off from the surrounding area by its "wall" (see fig. 4), but in less typical cases the two areas are not thus defined (fig. 5). The "wall" referred to above is not an independent structure as the description might suggest, but is merely formed by the peripheral tabellæ of the central column resting upon those below them.

The extrathecal area may attain a width equal to that of the medial area; the dissepiments are small and strongly arched, but are somewhat variable in size and form.

*Localities and Horizons.* *Corwenia rugosa* is a common and characteristic species of the Lower Carboniferous of North Wales and the North Welsh Border, but is mainly confined to the horizon of the Upper Brown Limestone (D 2).

Our material has been in the main obtained from Hafod-y-Calch, Corwen, Merionethshire (type-area); Treflach (near Oswestry), Shropshire; Llangollen, Montgomeryshire; Mold, Flintshire; Tyn Llanfair (Vale of Clwyd), Denbighshire; and from the shores of the Menai Straits, near Bangor, Carnarvonshire, where many forms with small diameter (*Lithostrotion* type) occur.

Outside this area the species does not appear to be common. It has been collected by Mr. Charles Edmonds in the Spotted Beds of the Fourth Limestone, near Egremont, Cumberland \* (R. 25031); and by the late Mr. Phillip Roscoe, from about the horizon of the Hardraw Scar Limestone, at Cam Beck, north of Settle, Yorkshire † (R. 23839-40)—in both cases from the same subzone as that in which it occurs so abundantly in North Wales. The British Museum possesses a specimen (R. 1355) from Co. Limerick, Ireland (horizon not known, presumably higher Viséan); and the species is described and figured by de Koninck from the Viséan of Visé ‡.

We are much indebted to Mr. Charles Edmonds, Dr. Edward Greenly, Dr. L. Kingsford, and Mr. H. P. Lewis for specimens they themselves have collected, and to Dr. F. A.

\* In the Clint and Esket Quarries, north of Egremont. See also Edmonds, Geol. Mag. 1922, vol. lix. pp. 81-82.

† Cam Beck is a tributary of the Ribble below Cam Fell. See "Geology of Ingleborough," 1890. Mem. Geol. Sur. p. 81.

‡ "Animaux Foss. du Terr. Carb. Belg.," 1842-44, p. 19, pl. D. fig. 3; "Nouvelles Recherches," Mem. Acad. Roy. Soc. Belg. 1872, vol. xxix. pp. 20-22, pl. i. figs. 1 a-d.

Bather for the use of specimens in the British Museum. One of us (S. S.) has, in conjunction with Dr. Greenly, collected the species in the neighbourhood of Bangor.

*Corwenia vaga*, sp. n. (Pl. V. figs. 6-15.)

*Holotype*. R. 25,009, British Museum.

Clitheroe Limestone, Withgill Knoll, Clitheroe.

Collected by the Rev. George Waddington, S.J.

The species is only known to us from Withgill Knoll, an outlier of Clitheroe Limestone, 2 miles west by south of Clitheroe. The knoll is regarded by Mr. Donald Parkinson as equivalent to the Upper *Seminula* Zone, S 2. The coral, although not rare, has been found in fragments only, and neither the Rev. George Waddington nor Mr. Parkinson, to whom we are indebted for our material, have found the coral in a position of growth or in large masses. The broken corallites are embedded in a light-coloured, highly crinoidal limestone. Mr. Parkinson has supplied us with the following list of fossils found associated with *Corwenia vaga*:—*Michelinia* sp.; *Syringopora* cf. *reticulata*, Goldfuss.; *Leptena analoga* (Phillips); *Productus* aff. *concinus*, Sowerby; *P. margaritaceus*, Phillips; *P. semireticulatus* (Martin); *Pustula ovalis* (Phillips); *Pustula plicatilis* (Sowerby); *Pugnax mesogonus* (Phillips); *Pugnax pleurodon* (Phillips); *Schizophoria resupinata* (Martin); *Streptorhynchus senilis* (Phillips); *Conocardium hibernicum*, Sowerby; *Conocardium inflatum*, McCoy; *Straparollus dionysii*, de Montfort; *Platyceras veritoides*, Phillips.

The corallum is placeloid, and the corallites are cylindrical as in *Corwenia rugosa*. The annulations on the epitheca are strongly marked and very frequent, but the extreme inequalities in diameter, noted in describing *Corwenia rugosa*, are not developed to the same extent in the Withgill species. The only calice seen is that in the type-specimen, which closely resembles *Lonsdalia duplicata* (see Q. J. G. S. vol. lxxi. p. 240). The great variability in the internal structure of the species implies, however, that an equally variable character must be looked for in the calice. The diameters of the largest corallites range from 15 to 17.5 mm.

*Internal Characters*. As the trivial name implies, the internal structures of the corallites vary in their details to a very marked degree—so much so, in fact, that, were the same degree of difference observed between specimens of simple corals, the extremes would, in the absence of intermediate forms, be interpreted as different species, if not



different genera. There are about thirty major septa present in the ephelic stage.

*Corwenia vaga* may approach *Corwenia rugosa*, and therefore *Dibunophyllum*, very closely in all respects, except that its tabular tissue is never strongly differentiated into two distinct areas as it is in those. Nevertheless, when seen in transverse section, it may appear to have a central column as well, or even better, developed. It may, on the other hand, show marked convergence towards *Koninckophyllum*, Thomson.

The details and variations of structure can be most clearly stated in terms of the transverse and longitudinal sections.

#### *Transverse Section.*

##### 1. "*Dibunophyllum*" type (Pl. V. figs. 8, 9, 10).

(The descriptive term "*Dibunophyllum* type" is appropriate only to the transverse section, since in every case the longitudinal section bears a closer resemblance to *Koninckophyllum* than to *Dibunophyllum*.)

The central column is cuspidate, is bisected by a medial plate, and may show a large number of septal lamellæ and tabellar rings. The septa are united to the epitheca, and usually but not invariably reach the columella. The dissepimental area is narrow and distinct.

##### 2. "*Koninckophyllum*" type (Pl. V. figs. 11, 12, 13).

The central column is very weakly developed, and may even be absent altogether from some particular section in a corallite; but this is not usual. It consists merely of a very short medial plate surrounded by a few curved tabular intersections and a few septal lamellæ. In some cases a number of very short septal lamellæ appear fringing the medial plate (fig. 13). The septa are very variable in character; they may or may not extend inwards as far as the central column, but they usually show some tendency towards dissociation from the epitheca with consequent development of large peripheral dissepiments (fig. 13).

The two types, described above, are linked by intermediate variations, in which the characters described under one or the other are combined. Moreover, sections representing both types may be obtained from the same corallite, and in such cases the *Koninckophylloid* section may occur earlier or later than the *Dibunophylloid*.

#### *Longitudinal Section.* (Pl. V. figs. 6 & 7.)

As we have already shown, the central column is never

clearly differentiated from the medial area, but the tabellæ are more strongly inclined and more numerous at the centre of the corallite than elsewhere.

In those corallites showing a *Dibunophyllum* type of transverse section, the medial plate is persistent, and the tabellæ are strongly inclined and tend in some cases towards forming a central column (fig. 7). But in those displaying cross-sections of the *Koninckophyllum* type, the characters displayed are those often seen in longitudinal sections of *Koninckophyllum*—namely, an impersistent medial plate and almost horizontal tabellæ (fig. 6).

The extrathecal zone is in all cases a narrow one.

### *Remarks upon the Ontogeny and Phylogeny of Corwenia.*

For further notes on the development of *Corwenia rugosa*, see Quart. Journ. Geol. Soc. (1916) vol. lxxi. for 1915, pp. 267–8, pl. xxi. figs. 3, 7–14, and for the ontogeny of *Lonsdaleia*, to which reference is made in the following remarks, *op. cit.* pp. 230–5, pl. xvii. figs. 5–24. In the paper quoted the development of the central column is described in some detail, and therefore need not be discussed here.

*Corwenia rugosa*. The corallites bud from the margin of the parent calice, singly or several at a time, and develop at the side of the parent corallite without detriment to it, thus conforming to the more usual form of gemmation among the Rugose Corals. Marked rejuvenescence frequently synchronizes with gemmation, and consequently the young corallites rise from ledges on the side of the old one. (Q. J. G. S. vol. lxxi. pl. xxi. fig. 3.)

The developmental phases of the corallite can conveniently be divided into three stages—the “hystero-brephic” stage (corresponding in part, but not entirely, to the “brephic” or “nepionic” stage in a simple coral, which is omitted altogether by the hystero-corallites in some genera), the “hystero-neanic,” and the “hystero-cphebic.”

*The Hystero-brephic Stage*. The corallite begins as a ring of epitheca and a fringe of short septa; next, an axial or long counter-septum is developed, which completely or almost completely bisects the area within this ring; then certain of the other septa grow inwards beyond the rest, and reach the centre of the corallite. The central column develops round the middle part of the axial septum and the axial ends of these. Q. J. G. S. vol. lxxi. pl. xxi. fig. 7

shows several corallites at the earliest phase of this stage, and still embedded in the tissue of the parent; fig. 8, same plate, is a corallite at a later phase of the stage.

*The Hystero-neanic Stage.* This stage begins with the formation of the central column, which at first is indefinite and variable, and appears in transverse section as a loosely constructed mesh enclosing the axial ends of the septa. The minor septa and dissepiments both make their appearance at an early phase of the stage, and the medial plate, although present from the beginning, is at first usually flexed and quite inconspicuous. (Q. J. G. S. vol. lxxi. pl. xxi. fig. 9 earliest phase, fig. 10 middle phase, and fig. 11 late phase.)

*The Hystero-ephebic Stage.* The corallites most characteristic of the species possess the following characters:—The central column is well defined, and the medial plate is straight and stout, but not excessively thickened; the major septa reach the central column, and some enter it, but the septa and septal lamellæ are for the most part distinct; the minor septa even at this stage are little developed; and the dissepimental zone attains its maximum width. (Pl. V. figs. 2 & 3.)

*Corwenia vaga.* Gemmation as in *C. rugosa*? The corallites develop along precisely the same lines as the genotype, but the hystero-brephic stage is more prolonged and its subsequent development is less regular.

Both species of *Corwenia* closely agree with those of *Lonsdaleia* in their hystero-brephic stage, and differ from *Dibunophyllum* in its earliest stage. But one must bear in mind the fact that in *Corwenia*, as in *Lonsdaleia*, we are considering the development of hystero-corallites (the product of gemmation), and not, as in the case of *Dibunophyllum*, a proto-corallite (the direct development from an embryo). (In the brephic stage in *Dibunophyllum*, the septa then present meet at the centre of the coral, and at the commencement of the neanic stage separate, leaving the axial septum to develop into the medial plate and the counter and cardinal septa.)

In the hystero-neanic and hystero-ephebic stages, *C. rugosa* is identical in its structure with the less specialized forms of *Dibunophyllum*, but the corallites never attain to the same degree of specialization as do the more highly developed forms of that simple genus. In these the corallite, often markedly turbinate, may attain a diameter of 5 centimetres or more, develop a wide extrathecal zone and correspondingly long minor septa, and the major septa end axially before they reach the central column.

In our opinion, *Corwenia rugosa* is derived directly from the simple genus *Dibunophyllum*, presumably from the earlier and unspecialized D1 forms; but we consider that its development into a highly compound coral justifies generic recognition.

Although *Corwenia vaga* may be closely related to *C. rugosa*, and therefore to *Dibunophyllum*, it may, on the other hand, have developed from some other, yet cognate, coral; should this be the case, *Corwenia* is a polyphyletic genus.

*Notes upon a Coral, gen. et sp. n., in the British Museum.*  
(R. 22,380.) (Pl. VI. figs. 1, 2.)

The form here briefly described resembles *Corwenia rugosa* in being a compound coral and in having a central column of the same general structure, but differs markedly from that species in most other respects. The specimen is in the form of a water-worn pebble of fine compact limestone; the coral itself is of a creamy-white colour, but the matrix is of a deep red. Nothing is known of the specimen's history beyond the fact that it is an early acquisition. The old label attached to it states that it is from Bristol, but lithologically it is so unlike any rock-type known from that area that we have no hesitation in suggesting that the locality is wrongly stated. Moreover, since the specimen is a rounded pebble, the fossil was certainly not *in situ* wherever it may have been found. Under these circumstances, it is not desirable to give a name to the species. The coral is described with the species of *Corwenia* as an instance of homœomorphy and in order at the same time to give publicity to the form, since this may lead to its identification with some specimen of known locality and horizon.

*External Characters.* The corallum is phaceloid and the corallites are cylindrical, erect, and free; but are closely set and are joined at irregular intervals by radicleform extensions of their dissepimental tissue. The average diameter of the corallite is 4 mm., the character of the calice is not known.

*Internal Structures.* The central column forms nearly one-third of the corallite, the medial or tabular zone is extremely narrow, only about one-sixth of the radius, while the dissepimental zone is wide, occupying about one-half the radius.

The central column is strongly developed and is very compact in structure; the tabellæ are numerous and regular

—there being about six in a millimetre; the medial plate completely bisects the central column; and the septal lamellæ are about equal in number to the major septa.

The tabulæ are much more widely spaced than are the tabellæ of the central column—two or three only to the millimetre,—and are very irregular in their distances apart and in their inclination.

The dissepiments are large for the size of the corallite, appear unusually straight in longitudinal section, and are highly inclined, except where the extrathecal tissue is produced into horizontal connecting outgrowths, where they bend into a horizontal position. (See Pl. VI. fig. 2.)

There are about twenty septa in each cycle. The major septa extend almost, though not quite, to the central column, and either end abruptly or become suddenly and extremely attenuated at a short distance from it. The minor septa are only one-third the length of the major. All septa are very stout at the periphery of the corallite, and between them, and almost extending the entire length of the minor septa, is a deposit of stereoplasm, which welds their basal parts into a solid outer wall. (This is well shown in Pl. VI. figs. 1 & 2.)

The structures which call for attention are:—the large central column, which, it should be noted, occupies almost the whole of the intrathecal region; the rather unusual type of dissepiments; the deposition of stereoplasm at the periphery of the corallite; and the union of the corallites in the manner described. It may be remarked that the development of a central column is characteristic of, but not peculiar to, corals of Viséan age, while the establishment of radiciform connections between neighbouring corallites is a feature particularly common among corals of Devonian age in North America, and deposition of stereoplasm between the septa is frequent among Silurian genera.

## EXPLANATION OF THE PLATES.

### PLATE V.

All figures except 1 and 3 *b* are magnified 1·5 diameters.

The letter R. followed by a number is the register-number of a specimen in the British Museum.

*Figs. 1-5. Corwenia rugosa* (M'Coy).

*Fig. 1.* Group of corallites, D 2, shores of Menai Straits, Vaynol Park, S.W. of Menai Bridge, Carnarvonshire. R. 22,131 (1).  
Collected by Dr. Edward Greenly.

*Fig. 2.* Transverse section. Topotype, Upper Grey Limestone, D 2, Hafod-y-Calch, Corwen, Merionethshire. R. 15,400. Collected by the late Dr. Arthur Vaughan.

Fig. 3 a. Transverse section,  $\times 15$ . R. 22,133.

Fig. 3 b. Same section. Natural size.

Fig. 3 is from the same place as fig. 1 (D 2, Vaynol Park, Carnarvonshire, collected by Dr. Edward Greenly). They both represent the small variety—"the *Lithostrotion* type"—characteristic of the Bangor district.

Fig. 4. Longitudinal section,  $\times 15$ . Upper Grey Limestone, D 2, Hafod-y-Calch, Corwen, Merionethshire. R. 25,011. Collected by Mr. H. P. Lewis.

Fig. 5. Longitudinal section,  $\times 15$ . The same horizon and locality as fig. 4, also contributed by Mr. Lewis.

Fig. 4 illustrates longitudinal section typical of the species having a strongly defined central column; fig. 5 is that of a corallite in which the central column is not so well developed.

Figs. 6-15. *Corwenia vaga*, sp. n. Paratypes. Clitheroe Limestone, Withgill Knoll, S 2, Withgill, Yorkshire, 2 miles S. by W. of Clitheroe, Lancashire. Collected by the Rev. George Waddington, S.J. All figures 15 times natural size.

Fig. 6. Longitudinal section, R. 25,012.

Fig. 7. " " R. 25,013.

Figs. 8, 9, 10. Transverse sections, the "*Dibunophyllum*" type. R. 25,014, R. 25,015, and R. 25,016.

Figs. 11, 12, 13. Transverse sections, the "*Koninckophyllum*" type. R. 25,017, R. 25,018, and R. 25,019.

Figs. 14, 15. Transverse sections, at the hystero-brephic and neanic stages respectively. R. 25,020 and R. 25,021.

#### PLATE VI.

A Coral, gen. et sp. n., in British Museum (R. 22380), in a pebble said to have come from the Carboniferous of Bristol. Both figures magnified 4 diameters.

Fig. 1. Transverse section.

Fig. 2. Longitudinal section.

### XIX.—Notes on the Cephalopoda.—No. 1. Descriptions of Two new Species of Octopus from Southern India and Ceylon. By G. C. ROBSON, M.A.

(Published by permission of the Trustees of the British Museum.)

ON a recent visit to Ceylon Mr. R. Winckworth made an examination of the collection of Cephalopoda in the Colombo Museum, and his list of the species in that collection is now in the press ('Colombo Journal of Science'). In this series of specimens he found two octopods which he was unable to identify. On his return to England he handed them over to me for examination and a report. The result of this study is now given.

Fig. 1.

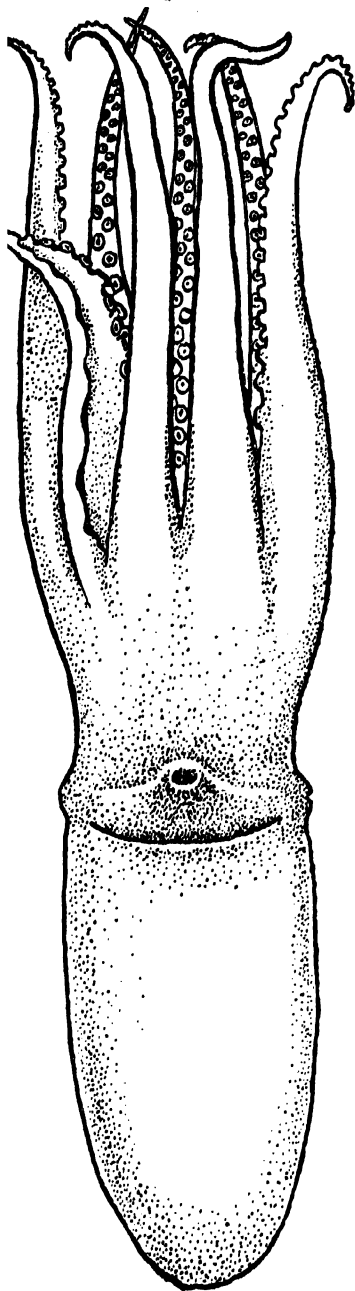
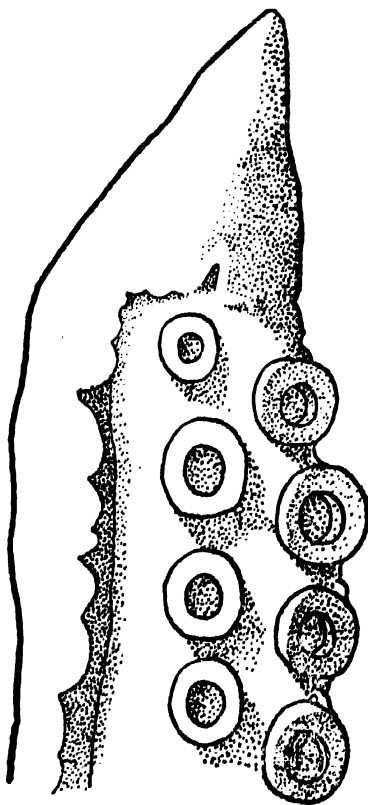


Fig. 2.



The forms herein described were not allotted new specific status without considerable hesitation. The descriptions of Octopoda, especially of the Indo-Pacific forms, are in a very unsatisfactory condition, many being incomplete and founded upon the most unreliable characters. It cannot be said, however, that any form hitherto described may be confused with the species described below, though the peculiar relation between *O. winckworthi* and Vérany's *O. alderi* (= *O. macropus* juv., *vide* Naef, 1923) is fully set forth below.

I hope to prepare in due course a more satisfactory classification of the Octopodidæ than is at present available, and to employ therein some of the characters—*e. g.*, pallial locking-apparatus, radula, gills, closure of the mantle-aperture, &c.—which have been neglected in the past. Some of these characters have been shown by recent investigation to be of considerable bionomic importance.

It may be pointed out that *O. winckworthi*, one of the species now described, is apparently a surface-swimmer. *O. taprobanensis*, however, is structurally the more interesting form; the long cuttle-like mantle and very efficient adhesive apparatus suggest that it is a rapid and agile swimmer.

The thanks of both Mr. Winckworth and myself are due to Dr. Raj, Director of the Madras Fisheries, and Dr. Pearson, Director of the Ceylon Fisheries, from whom these specimens were received.

The specimens have been presented by Mr. Winckworth to the Zoological Department of the British Museum, and I must take this opportunity of thanking Mr. Winckworth for his assistance in this study.

#### *Octopus winckworthi*, sp. n.

One specimen (♂) from Tuticorin, the exact locality unknown, but probably from pearl-oyster beds (about 8 fathoms) or chank-beds (about 11 fathoms).

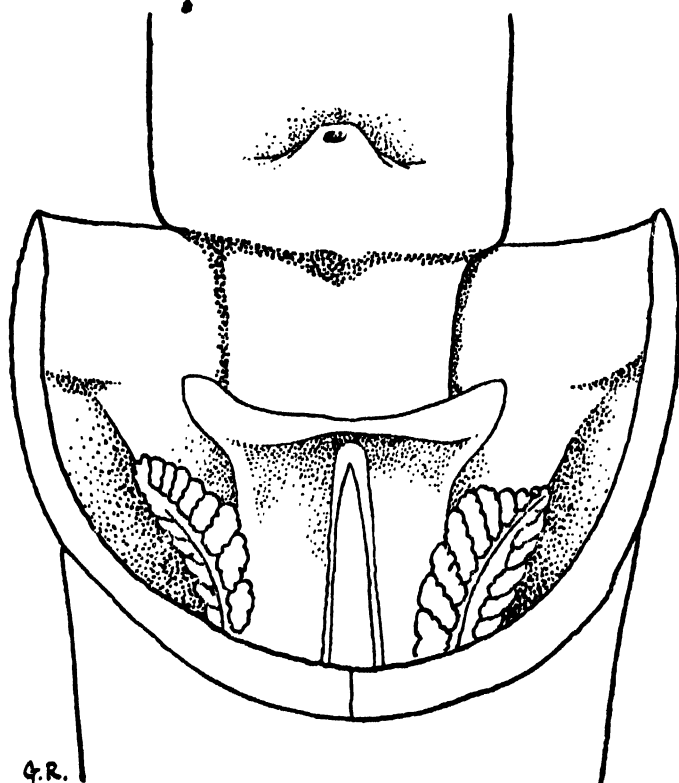
*External Appearance* (fig. 1).—The animal is remarkably slender, the breadth of the visceral sac being half the length. The visceral sac is oblong and the sides are parallel, the apical extremity being gently rounded off. The arms are about one and a half times as long as the body (apex of visceral sac to the eye), and are therefore very short. The skin is smooth and soft, though under the microscope it is seen to be covered with very weak wrinkles and excrescences, which may be partly the effects of preservation. The mantle-aperture is moderate in width, extending two-thirds of the



way from the funnel to the eye. The funnel is short and is very much involved in the tissues of the head. The eyes are small and project very slightly from the sides of the head.

The colour is in general a dull purple on the dorsal surface, which is due to the presence of very numerous bluish-black

Fig. 3.



*Octopus winckworthi*, sp. n. Pallial cavity.  $\times 2.75$ .

and brown chromatophores. Over this is found a number of large irregular blotches and streaks of a deeper colour, which give the impression of a weak marbling. On the ventral surface the colour is lighter, owing to the greater diffusion of the chromatophores.

*Dimensions.*

	mm.	
Total length.....	93	
Visceral sac, breadth .....	17	
" " length .....	35	
Head, breadth .....	17	
Mantle-aperture .....	14	
	R.	L.
	mm.	mm.
Arms: length, 1st pair .....	43	43
2nd pair .....	43	43
3rd pair .....	(27)	50
4th pair .....	44	44
	mm.	
Umbrella: depth between arms 1—1 ..	13	
1—2 ..	15	
2—3 ..	16.5	
3—4 ..	15	
4—4 ..	15	

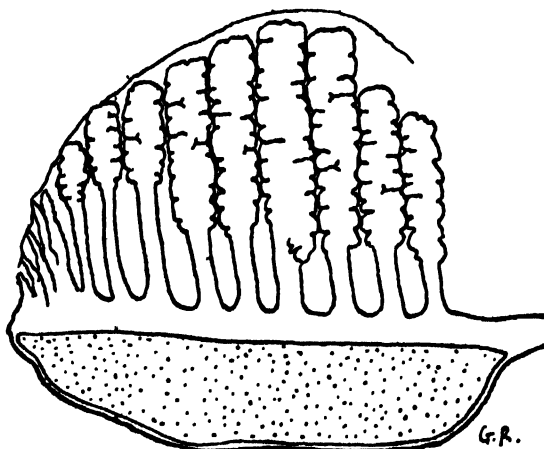
The *arms* are gently tapered and exhibit, *e. g.*, on pair some sixty-two to sixty-four suckers of normal size. The *hectocotylus* (fig. 2) has the appearance incompletely developed, as the extremity is not different though the calamus is well developed. I am, however, that the lack of differentiation at the extremity is necessarily a juvenile character.

On opening the mantle-cavity (fig. 3) one is at once struck by the extremely efficient adhesive mechanism. The apparatus is situated very low down in the mantle-cavity, far lower than is usually the case. The ridges of the cephalic component are very strong and remarkably prominent. They fit into deep and well-marked cavities on the inner surface of the mantle. The inner aperture of the funnel is very deeply situated.

The *gills* (fig. 4) consist of nine filaments in each demibranch (eighteen in each gill). It is a remarkable fact that, although this is a shallow-water form, the inner demibranch shows signs of marked reduction in the length of the individual filaments. The last three filaments are considerably under half the length of the filament-rachis. The inner demibranch is, of course, always somewhat smaller than the outer (*e. g.*, in *Octopus vulgaris*), but in the present case one is reminded of the condition found in certain deep-sea forms (Robson, Proc. Zool. Soc., in the press).

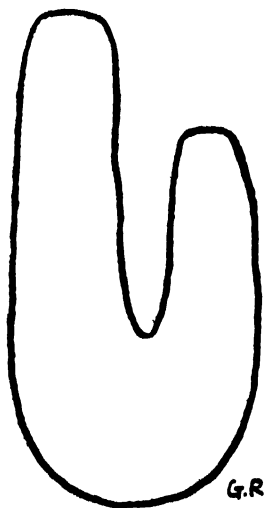
The *funnel-organ* (fig. 5) is of the *Scæurgus*-type, while the outer limb of each half is smaller than the inner.

Fig. 4.



*Octopus winckworthi*, sp. n. Gill (inner demibranch).  $\times 6$ .

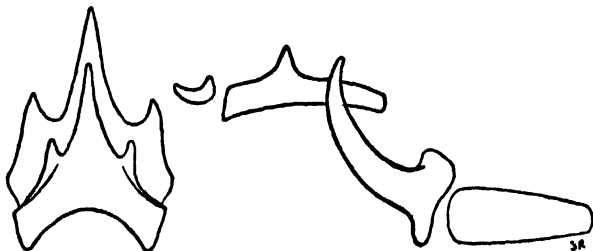
Fig. 5.



*Octopus winckworthi*, sp. n. Funnel-organ (left half).  $\times 13$ .

The *radula* (fig. 6) is not remarkable in any way except for the admedian position of the mesocone on the second lateral tooth. The rhachidian tooth is of the type designated by me (1925, p. 105) as  $A_3$ —that is to say, the cusp-seriation is regular, not alternating, and the outward migration of the ectocone occupies four teeth, as in *O. alderi*, *granulatus*, &c. There is no entocone on the second lateral. The marginal plates are long and cone-shaped.

Fig. 6.



*Octopus winckworthi*, sp. n. Radula.  $\times$  circ. 25.

The type of this species is deposited in the Zoological Department, British Museum (Natural History).

*Octopus taprobanensis*, sp. n.

*Octopus* sp. (near *O. alderi*), Winckworth, Colombo Journal of Science, 1925 (in the press).

Mr. R. Winckworth (*l. c.*) has given a full account of the external features of this species. He failed to identify it with any known form, but he noted the general resemblance to *O. alderi*, Vérany, a Mediterranean form described in some detail by Jatta (1896, p. 228). Upon closer study, however, there emerge certain marked differences which serve to distinguish these forms, though there can be no doubt that there is a close superficial resemblance. The following notes may be added to Mr. Winckworth's description:—

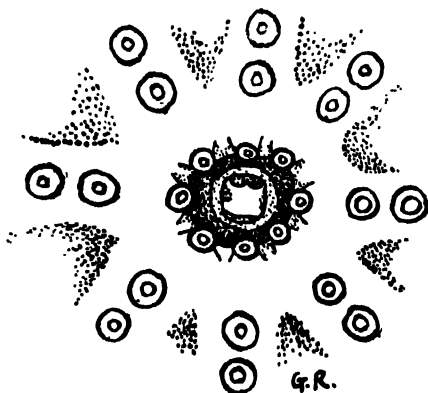
1. The oral suckers (fig. 7) exhibit an uncommon arrangement. The first suckers, which are the smallest, form a ring closely encompassing the lips; they are separated by a wide space from the second suckers, which are twice as large as the first. This wide separation of the first suckers and their concentration round the lips is very unusual, and might at first seem to be a result of the downward contraction of the

arms. Comparison with other specimens which have contracted in this condition shows, however, that this is not the case.

2. The funnel-organ is W-shaped and the four limbs are very narrow.

3. Within the mantle-cavity there is a very marked transverse fold of the mantle-integument which is evidently part of the mechanism of adhesion. The cephalic part of the apparatus is, however, very weak. The ridge in question is far better developed than in any form which I have examined. In a form like *O. winckworthi*, in which adhesion is very effective, the pallial component is merely a cavity excavated

Fig. 7.



*Octopus taprobanensis*, sp. n. Oral suckers.

in the mantle-tissues, not a deep fold as in the present case. A similar fold is seen in Jatta's figure of "*O. alderi*" (1896, pl. vii. fig. 23), which emphasizes the resemblance between these forms.

4. The gill carries ten filaments in each demibranch.

*Octopus alderi*, Vérany, to which this species bears considerable resemblance, is considered by Naef (1923, p. 706) to be a juvenile stage of *O. macropus*. The present species differs from it in the following particulars:—(1) The umbrella is larger; (2) the disposition of the admedian suckers is peculiar and unlike the arrangement found in "*O. alderi*" and *macropus*; (3) the eyes are smaller (as compared, e. g., with those in Jatta's figure 22, plate xx.); (4) the funnel-organ is markedly different; (5) this specimen being only a

little larger than the specimen described by Jatta (17 mm. in mantle-length as compared with 15 mm.), the arms are relatively much longer (maximum of 41 mm., as compared with 27.5 mm. in the case of *alderi*); (6) in *O. alderi* the order of the arms (not always a satisfactory character) is 2.1.3.4, while in *O. taprobanensis* it is 1.2.3.4. More important to observe is the fact that the size-differences in the arms are very marked in *O. taprobanensis* (first arms, 39 and 41 mm.; fourth arms, 18 and 21 mm.), while in *O. alderi* the disparity is very slight (27.5 mm.; 20 mm.),

## BIBLIOGRAPHY.

- JATTA, G. 1896. 'Fauna u. Flora d. Golfes von Neapel,' Monogr. 23.  
NARF, A. 1925. 'Fauna e Flora del Golfo di Napoli,' Monogr. 35,  
part 2, p. 706.  
ROBSON, G. Journ. Linn. Soc. xxxvi. p. 99.

XX.—*Two new Species of Dytiscidæ.*

By A. ZIMMERMANN, Munich.

1. *Macroporus tristis*, sp. n.

Long. 5.3, lat. 3 mm. Broadly ovate, the point of greatest width in the middle, equally narrowed before and behind. Brownish black, finely pubescent. Clypeus rufous, sides of prothorax and of the elytra scarcely dilute. Surface with a distinct micropunctuation, only moderately shining, almost dull. Hind legs piceous, anterior and middle legs rufous. Head impressed on each side, very finely and sparsely punctate, the punctures being a little stronger on the front. Prothorax distinctly margined at sides; the punctuation is rather close and strong, being a little more sparse in a transverse area in the middle. Elytra shortly sinuated before the apex, coarsely, very closely and evenly punctate, but the punctures becoming obsolete near the apex. The punctuation of the metasternum, coxæ, abdomen, and epipleuræ is also coarse, but not quite so close as on the elytra.

FIJI Is.: Lautoka (*R. Veitch*).

Described from a single specimen; the type is in the collection of the British Museum, London.

2. *Hyphydrus flaviceps*, sp. n.

Long. 3-3.25, lat. 2-2.25 mm. Very broadly ovate, almost round, convex. Body beneath rufous or reddish

brown, above black. Legs, antennæ, and epipleuræ flavo-testaceous; head ferruginous, sometimes infuscate in the middle; the sides of the prothorax pale; two distinct fasciæ and a few spots on the elytra yellowish. The anterior fascia is irregular and undulated, broad at the sides, and reaching the shoulder, where it encloses a black spot, and becomes narrower towards the suture, which it does not touch. The posterior fascia is a little behind the middle, small, undulated; the two spots before the tip are generally connected with the posterior fascia by a submarginal vitta.

The punctuation of the head is fine and dense, of the prothorax stronger, but sparser at the sides than on the disc; on the elytra coarse, dense, generally evenly distributed, but more feeble at the base and almost entirely obsolete in a small area on the shoulder.

Clypeus finely but distinctly margined, head with a flat depression on each side.

♂ larger, shining, without alutaceous sculpture, the pro- and mesotarsi scarcely incrassate.

♀ with only the head shining, the thorax and elytra distinctly alutaceous and therefore opaque.

The new species is nearly related to *H. assinicus*, Rég.; but the pale head, the distinct broad fasciæ of the elytra, and the dull upper surface of the ♀ easily distinguish it from the latter.

SIERRA LEONE: Njala (*E. Hargreaves*).

Types in the British Museum, London; co-types in the author's collection.

**XXI.—The Family Franklinothripidæ, nov., with Description of a new Type of Thysanopteron.** By RICHARD S. BAGNALL, F.R.S.E., F.L.S.

WE have up to now recognized one family, *Æolothripidæ*, with three subfamilies (*Orothripinæ*, *Æolothripinæ*, and *Melanothripinæ*, mihi†) of the tribe *Æolothripoidea*. These divisions are, however, so strongly characterized in comparison with other recognized families of the Thysanoptera as to merit full family rank.

† Bagnall, 1912, Trans. 2nd Ent. Congress, Oxford, pp. 394-397; 1913, Journ. Econ. Biol. viii. pp. 155-158.

Of these the family Melanothripidæ is at once separated by its palpi and by the nature and structure of the antennæ and the antennal sensoria, approximating the Heterothripodea as regards the antenæ and the Heterothripodea and Thripodea in the maxillary and labial palpi.

The Orothripidæ and Æolothripidæ more closely approach each other than either of them approach the Melanothripidæ. Indeed, in diagnosing the genus *Archæolothrips* † from Australia, I show that the antennæ and antennal sensoria of these two divisions are closely related, and that the Æolothripidæ have almost certainly been derived from the Orothripidæ by the completed fusion of the numerous joints of the maxillary palpi to form the long second joint seen in the Æolothripidæ proper.

In examining some West African material, recently submitted by the Imperial Bureau of Entomology, I detected a large Terebrantian representing a new and curious type. On first examination I assigned it to the Thripodea in or near *Corynothrips*, but a closer study of the mouth-parts showed that it came into the Æolothripodea, and in its antennal and wing structure near *Franklinothrips*.

A study of the antennæ and of the wings of *Franklinothrips* in the light of this discovery demonstrates the necessity of removing the genus from the true Æolothripidæ, and I have therefore characterized the new family Franklinothripidæ herein. The wings do not conform with those of other families of the Æolothripodea, but rather approximate those of succeeding major groups; the antennæ are peculiar to the family; the palpi (and the form of abdomen and ovipositor in the genus *Franklinothrips*) are Æolothripid, but the abdomen and gonapophyses in the new genus are puzzling, and further material is necessary before the latter can be studied.

We now admit the following families of the Æolothripodea ‡ :—

OROTHRIPIDÆ, mihi.—Genera *Stomatothrips*, Hood; *Orothrips*, Moulton; and *Desmothrips*, Hood.  
 ÆOLOTHRIPIDÆ (Hal.), mihi.—Genera *Æolothrips*, Hal.; *Archæolothrips*, Bagn.; *Rhipidothrips*, Uz.; and \**Rhipidothripoides*, Bagn.

† Bagnall, 1924, Ann. & Mag. Nat. Hist. ser. 9, vol. xiv. p. 627.

‡ An asterisk denotes genera of which the known species are fossil.



FRANKLINOTHRIPIDÆ, mihi.—Genera *Franklinothrips*, Back, and *Corynothripoides*, Bagn.

MELANOTHRIPIDÆ, mihi.—Genera *Melanothrips*, Hal.; *Cranothrips*, Bagn.; \**Eocranothrips*, Bagn., ined.; *Ankothrips*, Crawf.; \**Opadothrips*, Priesner; and \**Archankothrips*, Priesner.

The status and position of the genera \**Pulæothrips*, Scudder, and \**Calothrips* is uncertain.

The discovery of both sexes of *Mitothrips megalops*, Trybom, fixes the species as a true *Franklinothrips*, and a table of the known species is published herein.

#### Family Franklinothripidæ, mihi.

Head otherwise than in the *Æolothripidæ*; anterior ocellus smaller than the posterior pair or absent. Antennæ very long and slender, joint 3 at least ten times as long as broad, alone as long as the head, and 3 and 4 without the elongated sense-arcs seen in the *Æolothripidæ* and *Orothripidæ*. Legs long and slender, fore-tarsal hook vestigial. Maxillary palpi geniculate, 3-segmented; labial palpi, 3- (? 4-) segmented. Wings slender, narrower in basal fourth than across base, and slightly widening in distal fourth. Fore wing with upper and lower veins weak, and cross-veins absent; costa fringed.

Abdomen wasp-like or elongated and linear.

#### Genus CORYNOTHRIPOIDES, nov.

♀.—Form long and slender; legs long and slender, as in *Franklinothrips*.

Head about as long to a line above eyes as broad, but conically produced beyond eyes for about as long as the breadth separating the eyes distally. Eyes moderately finely faceted dorsally, but ventrally considerably produced posteriorly and with larger and unequal facets. Antennæ nearly three times the total length of head. Wings narrow, broader at base than across the basal fourth; fore wing with longitudinal veins approximating close to the anterior and posterior margins respectively; cross-veins absent; surface microscopically and sparingly setose; costal fringe well developed.

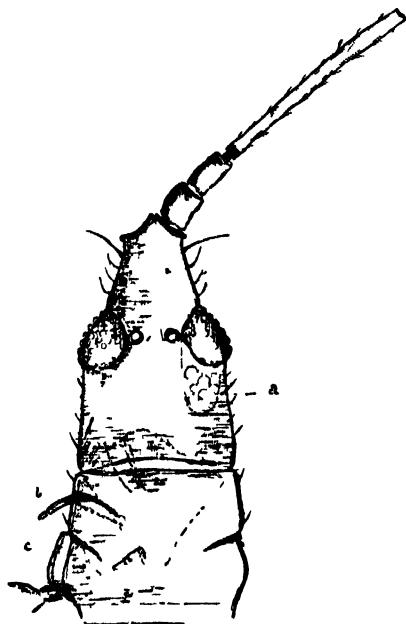
Abdomen elongated and linear with the last two segments apparently not modified as in other *Æolothripoides*, and the ovipositor less developed and curved.

Type. *Corynothripoides marginipennis*, mihi.

*Corynothripoides marginipennis*, sp. n.

♀.—Length about 3·0 mm.

Colour dark grey-brown to black-brown, including legs and basal antennal joints; abdominal segments 1-7 somewhat lighter. Antennal joints 3 and 4 pale yellow, 3 with stem, a narrow ring at base and extreme tip grey-brown, and 4 at base and extreme tip also grey-brown;



*Corynothripoides marginipennis*, gen. et sp. n.

Head, pronotum, and first three antennal segments.

a, ventral extension of eye; b, maxillary palpus; c, fore coxa.

segments 5-9 dark grey-brown. Lengths of antennal joints 3-9 approximately:—

335 : 186 : 100 : 83 : 80 : 58 : 21 microns.

Third joint as long as head, and about 18 times as long as broad.

Fore wing narrow, about 14 times as long as broad near middle, but slightly broader in distal fourth; scale and a band along posterior margin, including lower longitudinal vein, grey-brown, which is continued round the tip and

along the anterior margin (including the fore vein) to about middle of wing.

Type. British Museum.

*Hab.* SIERRA LEONE, Taninahun, 6. ii. 25 (*E. Hargreaves*), 1 ♀, I.B.E., Lg. 190.

### Genus FRANKLINOTHRIPS, Back.

*Franklinothrips*, Back, 1912, Ent. News, xxiii. (Feb.).

*Mitothrips*, Trybom, 1912, Ent. Tidskr. xxxiii.

I have already pointed out (*Journ. Econ. Biol.*, Sept. 1913, viii. p. 157) that, in describing the genus *Mitothrips*, Trybom himself regarded his species (described from the ♂) as congeneric with the then recently described Nearctic species *vespiformis*, *longiceps*, and *nasturtii*, and that before Trybom's paper was published Back had diagnosed the genus *Franklinothrips* with *vespiformis* as the type. Hood has shown that *longiceps* and *nasturtii* are not congeneric, so that the genus only includes three species. Two of these are Nearctic of which females only are known, whilst the third is African and until now only known from the ♂, the discovery of the other sex described hereafter definitely fixing the genus of the species.

The following is a table based on characters of the female sex :—

- |   |                                   |
|---|-----------------------------------|
| 1. Abdomen with segments 1-3 and 10 pale.   |                                   |
| Species Nearctic .....  | 2.                                |
| Abdomen with segments 1-4 and 9-10 yellow. Antennæ with segments 1-4 pale yellow with apex of 4 brown; 3 about 13 times as broad near apex; 5-9 together 1.1 times as long as 3, and 8 about 2.7 times as long as 5. Fore wings as in <i>tenuicornis</i> . The species African .....                            | <i>F. megalops</i> (Trybom).      |
| 2. Antennæ less slender, segments 1-3 clear pale yellow; 3 about 11 times as long as broad near apex; 5-9 together about 1.3 times as long as 3, and 8 about 2.5 times as long as 5. Fore wing near apex with a rather poorly-defined spot which does not attain the ring-vein ..                               | <i>F. vespiformis</i> (Crawford). |
| Antennæ more slender, segments 1-4 clear pale yellow; 3 about 13 times as long as broad near apex; 5-9 together about equal to that of 3, and 8 about 3.7 times as long as 5. Fore wing near apex with a large distinct white area entirely occupying the space between the two portions of the ring-vein ..... | <i>F. tenuicornis</i> , Hood.     |

*Franklinothrips tenuicornis*, Hood.

*Franklinothrips tenuicornis*, Hood, 1915 (Apl.), Ent. News, p. 164, fig.  
*Mitothrips petulans*, Bagnall, 1915 (Sept.), Journ. Linn. Soc., Zool.  
 xxxii. p. 496, pl. xlviii. figs. 1-5, pl. xlix. figs. 1, 2.

The above synonymy does not appear to have been noted. Although my paper containing the description of *M. petulans* was prepared prior to July 1914, and presented in November 1914, publication was not secured until late in 1915 on account of war-conditions.

*Franklinothrips megalops* (Tryb.).

*Mitothrips megalops*, Trybom, Ent. Tidskr. 1912, xxxiii. pl. ii. p. 147.

I have recently received 4 ♀♀, and 1 ♂ of an *Æolothripid* (s. l.) from Natal; the ♂ is obviously *Mitothrips megalops* of Trybom, and I have little hesitation in referring the ♀♀ to the same species, the sexes being strongly dimorphic. This material shows that *Mitothrips* is a true *Franklinothrips*, and I have little doubt that when the ♂♂ of *vespiformis* and *tenuicornis* are discovered they will exhibit the same characteristics in the structure of head, prothorax, and antennæ as does the ♂ *megalops*.

♀.—This species comes nearest to *tenuicornis* in the coloration of antennæ and wings. The antennæ have the joints 1-3 wholly pale yellow, and 4 darkening to a deep brown in the distal third or thereabouts. The femora are yellowish shading to brown, and lighter than the tibiæ. The abdomen has the first four segments (comprising the wasp-like waist) of a light golden-yellow, and the two apical segments of a somewhat deeper yellow; segment 1 laterally and 2 laterally and anteriorly are lightly touched with grey-brown, whilst a transverse band of dark blackish brown emphasises the junctures 2 and 3, and 3 and 4, respectively; segments 5-7 are of a deep blackish brown, and 8 not quite so dark. Bristles of segments 9 and 10 pale.

The head and prothorax are broader than in *tenuicornis* or *vespiformis*, and the lengths of the antennal joints 3-8 are approximately as follows:—

307 : 160 : 112 : 83 : 62 : 60 : 18.5 microns.

*Hab.* S. AFRICA, Mossel Bay, Cape Province, April 1921 (Brit. Mus. 1921-210).

XXII.—*The Generic Position of certain African Muridæ, hitherto referred to Æthomys and Praomys.* By OLD-FIELD THOMAS.

IN a paper recently published on the Shortridge mammals from S.W. Africa\*, mention is made of three Muridæ under the names of *Praomys namaquensis*, *P. collinus*, and *P. monticularis*; but occasion has now arisen to re-examine these species and to test their reference to the genus *Praomys*, and at the same time to make a similar inquiry as to certain other African Muridæ.

Firstly, as to the position of "*Praomys*" *namaquensis*. I find that, in spite of its comparatively small size and slender build, it is essentially a member of the genus *Æthomys*, having all the skull and tooth characters which are shown in the synopsis below as belonging to that genus. The number and position of the roots of the first molar are especially to be noted, there being, as in a large number of widely different forms (e. g., *Taterona*), two main roots, anterior and posterior, a middle-sized internal, and a small external median root, four in all, in contrast to the condition in *Praomys*, where the last-mentioned root is absent, so that there are only three altogether.

I may note that this reference to *Æthomys* is correctly given in a manuscript list of African Muridæ, left by our lamented friend Capt. P. S. Kershaw, whose untimely death has deprived us of one from whom we had hoped to obtain much valuable scientific work.

Next, the remarkable species "*Dasymys*" *longicaudatus*, Tullberg, of the Congo area, re-named *Mus sebastianus* by De Winton, may be considered. Here we have the peculiar fur, scaly naked tail, and various skull-characters (indicated in the synopsis) of so distinctive a nature as evidently to demand special generic recognition. The roots of *m*<sup>1</sup> are five in number, there being two small internal roots and a small median external one, besides the two main anterior and posterior roots.

The genus may be named *Stochomys* from the Greek for a target or shooting-mark, carrying out Mr. de Winton's idea of likening the bristle-hairs to arrows shot into the animal.

With regard to the small short-limbed "*Praomys*" *collinus* and *monticularis*, inhabitants of the peculiar area of S.W. Africa, Capt. Shortridge has drawn my attention

\* P. Z. S. 1925, pp. 237-8.

to the difference in habits and agility of these little mice in contrast with those of "*Praomys*" *namaquensis*. He says: "I must tell you of one thing from which I differ, namely, those small rock short-legged mice being grouped with '*Praomys*.' During life they are quite 'leggada-like' in shape, and not active, while *Praomys namaquensis* is one of the most active things I know, and in a room can jump almost to the ceiling."

On studying the essential characters of these animals, his observations are fully confirmed. For not only are these species generically distinct from *Æthomys* and true *Praomys*, but they prove to have certain peculiar structural molar characters which altogether remove them from the Murinæ and affiliate them to the Dendromyinae.

Of these molar characters, Mr. Hinton has been good enough to contribute the following expert description:—

"Cheek-teeth, as in other Dendromyinae, characterized by the moderately large size of the median row of tubercles; great size of the outer tubercles in upper, and of the inner tubercles in lower molars; and by the great reduction of the inner tubercles in upper, and of the outer tubercles in lower teeth. Molar crowns low, with thick rounded tubercles, formed and alternating much as in *Malacothrix*, not tall and compressed, with well-marked inclination (backwards in upper, forwards in lower molars), nor tending to form perfectly transverse laminæ as in *Steatomys*; crown-structure much simpler than in *Malacothrix*, reduced to about the same extent as in *Steatomys*;  $m^1$  with its anterior lamina reduced, consisting chiefly of the median tubercle  $x^*$ , with which is fused a small vestige of the outer cusp 1, while on the inner side a microscopic basal cingulum seems to represent the last trace of  $x^1$ ; second lamina composed of a large cusp 4, a smaller cusp  $y$  (or 'protoconule'), which is connected anteriorly with  $x$  by a low ridge, and a still smaller cusp 6 (or 'protocone'); of these three elements, 4 and 6 are opposed, while  $y$  is forwardly placed, blocking the valley between the first and second laminæ; third lamina with a large outer tubercle 5 and a greatly reduced inner tubercle 7, which is connected anteriorly with the inner and hinder termination of cusp 4 by a small median tubercle  $z$  ('metaconule'), and posteriorly with the hinder end of cusp 5 by another ridge-like median tubercle  $z^1$ ; the elements  $z$ , 7, and  $z^1$  form a V;  $m^2$  exactly like  $m^1$  minus the anterior lamina;  $m^3$  greatly reduced, not

\* "For the cusp-nomenclature used, see Barrett-Hamilton and Hinton, Hist. Brit. Mamm. ii. pt. xvi. p. 499, pl. xxviii. (1914)."

more than one-third size of  $m^2$ , with indistinct traces of three tubercles, two anterior and one postero-internal.

"In lower molars outer tubercles represented only by a microscopic vestige of 6 in  $m_1$ , lying between the bases of cusps  $y$  and  $z$ ; apart from this vestige the crown of the latter tooth is formed by six alternating tubercles, three internal (1, 4, and 5) and three external ( $y$ ,  $z$ , and  $z^1$ ); the cusp  $z^1$  forms the anterior end of the tooth, but when the latter is quite unworn a small trace of cusp 3 is probably to be seen at the inner end of  $z^1$ ;  $m_2$  is almost exactly like  $m_1$  minus the anterior lamina, but cusp 1, the smallest of the three inner tubercles in  $m_1$ , is in this tooth still more reduced ( $z^1$ );  $m_3$  is as reduced as its opponent."

The genus may be named *Petromyscus*, from the character of the country in which it occurs and the rock-haunting habits of its members.

Then in trying to find the proper limits of *Praomys*, based on *P. tullbergi*, of Ashanti and the Gold Coast, I find that, on the one hand, Miller's *Mus defua* differs in so many peculiarities as itself to deserve generic distinction; and on the other, that the little bush-mice of the Congo Forest also form a group which may be treated as a special genus. The characters of both are indicated in the following synopsis of the six genera I should now recognize among these African Muridæ.

### 1. Stochomys, gen. nov.

Size comparatively large. Fur with elongated bristle-hairs intermixed. Tail very long, scaly, naked. Mammæ 1—2=6.

Cranial crests strongly developed, amphoral\*, that is, with well-marked postorbital projecting angle. Palatal foramina not or scarcely longer than tooth-row.

Molars laminate, their normal cuspidate character obsolescent.  $M^2$  with no antero-external cusplet.  $M^1$  with five roots, an anterior and postero-external large, two small internal, and one small median external.

\* A large number of the genera of Muridæ have their cranial ridges taking a peculiar characteristic course, with a more or less well-marked projecting postorbital angle. Such a course produces on the top of the skull a vase-shaped area, and on this account such ridges might be called amphoral, from the classical "amphora," while the common crests, which evenly converge forwards, might be called cuneate, as the space between them is more or less wedge-shaped. Amphoral crests are shown P. Z. S. 1890, pl. xlv. fig. 7 c, and cuneate, pl. xlv. fig. 4 c.

Genotype: *S. longicaudatus* (*Dasymys longicaudatus*, Tullb.\*; *Mussebastianus*, de Wint.†). Additional form: *S. l. ituricus*, Thos.

Range. West African Forest region.

Readily distinguishable by the laminate molars, the five roots of  $m^1$ , the strongly developed amphoral ridges, and other characters.

## 2. *ÆTHOMYS*, Thos.

Size large or medium. Fur long, coarse, without specialized bristles. Feet not broadened. Tail long, scaly, fairly well-haired, but not pencilled. Mammæ 1—2=6 or 0—2=4.

Skull strongly built, the crests well marked, not amphoral. Zygomatic plate much projected forward, its front edge with a tendency to being concave; anteorbital foramina widely open above. Palatal foramina long, penetrating between the molars. Bullæ generally large, often very large.

Molars broadly shaped, strongly cuspidate.  $M^1$  with four roots, of which the anterior, internal, and posterior are large and subequal, while a small one is present at the middle of the outer side; this arrangement is very common throughout the family.

Genotype: *Æ. hindei*, Thos. Other species: *kaiseri*, *noræ*, *medicatus*, *thomasi*, *bocagei*, *walumbæ*, *chrysophilus*, *stunarius*, *namaquensis*, and a number of subspecies.

Range. Ethiopian region.

*Æthomys* contains the ordinary terrestrial rats of Africa. Its broad cuspidate molars and cuneate crests and open anteorbital foramina are quite characteristic.

## 3. *DEPHOMYS*, gen. nov.

Size medium. Fur with some bristly hairs intermixed, less specialized than in *Stochomys*. Feet broad. Tail long, very thinly haired, not tufted. Mammæ 0—2=4.

Skull with large brain-case, the crests with a tendency to be amphoral. Zygomatic plate projected forward, though less than in *Æthomys*. Palatal foramina fairly long, but not penetrating between molars. Choanæ widely open. Bullæ small.

Molars cuspidate, a distinct antero-external cusplet on  $m^1$  and  $m^2$ .  $M^1$  with four roots, arranged as in *Æthomys*.

Genotype (and only species): *D. defua* (*Mus defua*, Mill.‡).

\* N. Act. Upsal. (3) xvi., "Muriden aus Kamerun," p. 36 (1893).

† Ann. & Mag. Nat. Hist. (6) xix. p. 463 (1897).

‡ P. Wash. Ac. Sci. ii. p. 635 (1900).



*Range.* As yet only known from Liberia.

A somewhat annectant form, with some of the characters of both *Æthomys* and *Praomys*; and a tendency to the amphoral ridges of *Stochomys*, which it also approaches by its bristle-mixed fur.

#### 4. PRAOMYS, Thos.

Size medium. Form slender. Fur soft, without longer bristles. Tail long, very finely-haired, not pencilled. Feet not broadened for climbing. Mammæ 1—2=6.

Skull slender, the rostrum long, the brain-case of normal proportions; crests either absent or very slightly developed, cuneate. Zygomatic plate projected forward, its anterior edge straight or convex. Palatal foramina long, penetrating between molars. Bullæ of average size.

Molars narrow, rather elongate,  $m^2$  longer than broad.  $M^1$  with only three roots, the small median external root of *Æthomys* absent.

Genotype: *P. tullbergi*, Thos. Other species: *morio*, *jacksoni*, *viator*, *montis*, and *delectorum*.

*Range.* Forest-region of West and Central Africa.

#### 5. HYLOMYSCUS, gen. nov.

Size small. Form slender. Fur very soft, fine, and woolly, without specialized bristles. Tail long, with very fine scales, finely haired, the tip rather more hairy. Feet generally broadened for climbing. Mammæ 1—2=6 or 2—2=8.

Skull with proportionally large brain-case and small muzzle. Crests not or but little developed, cuneate. Zygomatic plate not projected forward, scarcely visible from above. Palatal foramina usually not projecting between molars. Bullæ small.

Molars very small, their structure as in *Praomys*.  $M^1$  without antero-external cusplet, with three roots only.

Genotype: *Hylomyscus æta* (*Epimys æta*, Thos.\*). Other species: *alleni*, *denniae*, *stella*, *schoutedeni*, and *carillus*.

*Range.* West and Central African region.

This genus contains the little bush-mice of the West African forest. It is, no doubt, nearly allied to *Praomys*, of which it would seem to be an arboreal modification. Its chief distinguishing marks are the abbreviated zygomatic plate, the large rounded brain-case, and the small modified

\* Ann. & Mag. Nat. Hist. (8) vii. p. 591 (1911).

feet. Most of the species are very small, but *schoutedeni* and *denniae* are about equal to the species of *Praomys*.

#### 6. PETROMYSCUS, gen. nov.

Size very small. Fur soft and fine, without harsher piles. Tail comparatively short, little longer than the head and body; rather coarsely scaly, and its hairs rather numerous, though not hiding the scales, some 3-4 scale-rings in length, not lengthening terminally. Feet short and delicately formed; pollex short, with a small nail; hallux with a sharp claw; soles naked, the pads large and crowded closely together. Mammæ  $0-2=4$  or  $1-2=6$ .

Skull low, smooth, and without ridges. Interorbital region broad. Zygomatic plate little projected forward. Palatal foramina of medium length, very narrow. Choanæ narrow, the parapterygoid fossæ broad. Bullæ of average size.

Incisors rather bevelled in front, ungrooved. Molars quite different in structure from those of the previous Murine genera, and indicating membership of the Dendromyinae. All the cusps very low, their inner series reduced as in that subfamily, the cusps both above and below more or less alternated.  $M^1$  with three roots, as in *Hylomyscus* and *Praomys*.

Genotype: *P. collinus* (*Praomys collinus*, Thos.\*). Other forms: *bruchus* and *monticularis*.

Range. Rocky Desert region of S.W. Africa.

The discovery of this remarkable new genus must be credited to Capt. Shortridge, who obtained all its members on the second Percy Sladen Expedition to S.W. Africa, and also drew my attention to their peculiarities in habits.

They are rock-haunting mice, and their rather flattened skulls are, no doubt, an adaptation of the same type as that we recently described in the rock-dormice (*Gliriscus*) occurring in the same region. In other respects their skulls are not unlike those of *Hylomyscus*, but this resemblance is only accidental, since their real relationship, as indicated by their molar structure, is clearly with the Dendromyinae. Within this subfamily their nearest allies would seem to be *Saccostomus* and *Malacothrix*, from both of which they are readily distinguishable by many detailed characters.

\* P. Z. S. 1925, p. 237.

XXIII.—*Some new African Mammalia.*

By OLDFIELD THOMAS.

WHILE working at the Mammalia obtained by Capt. Shortridge during the Percy Sladen and Kaffrarian Museum Expeditions to S.W. Africa, certain mammals from other regions have proved to need description, and it seems best to publish these in a special paper, and not to mix them up with the Shortridge animals.

*Felis ocreata griselda*, subsp. n.

A very pale form of the African wild cat, the pallor tending in the direction of grey instead of buffy, as it does in other south-western forms. Upper surface almost without darker markings. Under surface dull, pale buffy whitish, with very faintly marked darker spots on the belly. Chin and throat hairs white with slaty bases. Back of ears ochraceous buffy. Bands across limbs faintly marked and inconspicuous, blackish. Palms and soles black, except just under the calcaneum. Tail greyish, its bands black, but not very broad, the black at the tip rather short.

Size apparently as usual, but no exact measurements available.

*Hub.* of type. Fifty miles south of Dombé Grande, Benguella, Angola.

*Type.* Adult skin. B.M. no. 25.5.16.1. Collected and presented by E. H. Buxton, Esq. One specimen.

This cat is somewhat like the Namaqua-land form of *F. ocreata*, but is more completely grey, the grey extending over the whole of the upper surface, while below the strong ochraceous buffy is replaced by dull whitish buffy. The light colour below will also distinguish it from *mellandi*.

*Felis ocreata namaquana*, subsp. n.

*Felis cafra*, Thomas & Schwann, P. Z. S. 1904, p. 174.

Much paler than *F. o. cafra*, and all the markings much less prominent. General colour above buffy greyish, the grey most marked on the hinder back. Darker markings scarcely perceptible on back and flanks. Under surface strong ochraceous buffy, except on the whitish chin, the belly-spots darker ochraceous. Back of ears deep ochraceous. Limbs with the usual dark markings present,

though less deep black than in *cafra* ; black of sole extending practically to the heel.

Skull as usual.

Dimensions of the type :—

Head and body 584 mm. ; tail 347 ; hind foot 149 ; ear 74.

Skull : greatest length 108 ; condylo-basal length 98.5 ;  $p^4$  on outer edge 12.5.

*Hab.* Namaqua-land, both Great Namaqua-land (Berseba) and Little Namaqua-land (Klipfontein). Type from the latter.

*Type.* Old male. B.M. no. 4.2.3.20. Original number 456. Collected 2nd May, 1903, by C. H. B. Grant, and presented by C. D. Rudd, Esq.

This cat, whose range covers a considerable portion of the high desert region of N.W. South Africa, is distinguishable from true *cafra* by its paler and more buffy colour above and by its strongly ochraceous belly, of which the dark spots are also a deep ochraceous instead of being black. The same greater infusion of ochraceous will equally separate it from the Rhodesian *mellandi*, which in addition has a less extent of black on the soles.

#### *Caracal caracal coloniae*, subsp. n.

Mr. Hollister may be followed in using the name *nubicus* for the pale Caracals which occur in East Africa and range southwards to Rhodesia and Damaraland.

But specimens from Central Cape Colony are of so much stronger and deeper a tone that they should certainly bear a special subspecific name. Dr. Matschie has shown, and I agree with him, that Gray's name *melanotis* was given as a substitute for the original *caracal*, and becomes an absolute synonym of it, and therefore no special S. African name is available. Taking as typical the fine Deelfontein examples obtained in Col. Sloggett's collection, I would describe the South African form as follows :—

Fur soft, woolly. General colour dark, with a purplish or vinaceous tone in it, approximating to "vinaceous-tawny" of Ridgway. Sides rather more greyish. Underside, on the coloured parts, similarly suffused with vinaceous ; chin and axillæ white ; inguinal region whitish with slaty bases to the hairs. Head-markings strong, the subaural patch deep black ; a black patch at the base of the whiskers ; back of ears and the pencils with comparatively few white hairs

among the black. Limbs like body, the hairs under the palms and soles with a variable tendency to black. Tail like body, scarcely lighter below; a few black hairs at its extreme tip.

Skull at a maximum of size.

Dimensions of the type:—

Head and body 768 mm.; tail 275; hind foot 204; ear 88.

Skull: greatest length 139; condylo-basal length 125; zygomatic breadth 98;  $p^4$  on outer edge 17·3.

A female paratype has a condylo-basal length of 114 mm.

*Hab.* Central Cape Colony. Type from Deelfontein.

*Type.* Old male. B.M. no. 2.12.1.6. Original number 288. Collected 25th May, 1902, by C. H. B. Grant, and presented by Col. A. T. Sloggett.

I quite fail to follow Dr. Matschie in believing so many races of the northern Caracals can be discriminated, but this warm-coloured southern form seems certainly worthy of a special name.

### *Mungos caurinus*, sp. n.

A rather small normal-coloured species with narrow bands.

General colour nearly as dark as in typical *M. mungo*, quite unlike that of the pale *M. talboti* of Bornu. Head of about the same brownish colour as the fore back, neither darker as in some forms nor paler as in others, transverse bands not strongly marked, the contrasts little conspicuous. Under surface brownish. Arms and legs brown, becoming black terminally on the metacarpus, fingers, and toes. Tail grizzled greyish, the small terminal pencil black.

Skull rather smaller than in *M. mungo*.

Dimensions of the type (collector's measurements):—

Head and body 385 mm.; tail 235; hind foot 72; ear 26.

Skull: greatest length 68·7; condylo-basal length 66; zygomatic breadth 39·6; intertemporal breadth 18·7; mastoid breadth 29·5; palatal length 34.

*Hab.* Portuguese Guinea. Type from Gunnal, alt. 50 mm.

*Type.* Old female. B.M. no. 10.4.9.4. Original number 82. Collected 12th July, 1909, by Dr. W. J. Ansorge. Two specimens.

This is a normal-coloured north-western form, differing by its bands from the unbanded *M. gambianus* of the Gambia, and by its fairly strong colour from the pale

*M. talboti* of Bornu. Probably it will be found to grade hereafter into others of the banded forms, but material does not at present exist to clear up its exact position. Its skull is conspicuously smaller than that of *M. gambianus*.

While examining the specimens of *Mungos* and the allied genus *Crossarchus*, my attention has been attracted to the animal described by Pousargues as *Crossarchus dybowski*, from the Congo, which appears to me to be so distinct from true *Crossarchus* that it ought to be generically separated, and I would suggest for it the name of *Dologale*. It is characterised by its normal snout, which is not lengthened as in *Crossarchus*, but is about as in *Mungos*, the skull not tapering anteriorly, but with an abrupt expansion of the lateral outline level with the orbits, in marked distinction to the even slope found in *Crossarchus*. Externally the space between the rhinarium and the upper lip is shorter than the diameter of the former, while in *Crossarchus* it is longer—and often very much longer. In the teeth there is a certain difference in structure, the two main cusps of  $m^1$  being appreciably nearer to the outer edge of the tooth than they are in *Crossarchus*, where they approach the central line of the tooth. Finally, the character of the pelage is completely different, the short, even, and finely punctulated fur contrasting with the loose and coarsely grizzled fur of *Crossarchus*.

These differences are quite as noticeable in contrast with the little *Crossarchus ansorgei* as they are with the very long-snouted *C. alexandri*, the most extreme member of that genus. Altogether, in spite of its unstriped coloration and its hairy heels, it is possible that *Dologale* is really more related to *Mungos* than it is to *Crossarchus*.

#### *Helogale mimetra*, sp. n.

A heavily punctulated species, resembling the geographically distant *H. atkinsoni*.

General colour uniformly brown, with but a very slight tendency to buffy or russet suffusion, the whitish punctulations well developed. Under surface like upper, but as usual without punctulations. Head of the same punctulated brown as the body, without special russet markings below ears, but there is a patch of russet on the sides of the nose. Underfur of back with the ends of the hairs dull russet. Hands, feet, and tail also grizzled brown, not blackish distally.

No dimensions available, the specimens being re-made skins, without skulls, but the general size appears to be about as in *H. brunetta*.

*Hab.* Ganguella, Angola.

*Type.* Adult male. B.M. no. 16.1.28.9. Collected and presented by H. F. Varian, Esq. Two specimens.

This Angolan *Helogale* is remarkably like the geographically far distant *H. atkinsoni* of Somaliland, but has not the marked yellowish line along the under side of the tail found in that species.

*Æthomys namaquensis calarius*, subsp. n.

Colour above as in true *namaquensis*, or a little paler, but below the whole under surface is pure white, the hairs white to the roots. Tail, however, very much shorter than in the more western forms, 150 mm. or less in adults.

Dimensions of the type :—

Head and body 112 mm.; tail 148; hind foot 23·5; ear 19.

Skull: greatest length 31·6; condylo-incisive length 28; upper molar series 5·1.

*Hab.* Ngami-land and Kalahari desert. Type from Lehutitung, 3300 feet.

*Type.* Adult female. B.M. no. 10.6.3.45. Original number 19. Collected 19th May, 1909, by R. B. Woosnam. Two specimens from Lehutitung and one from the Tama-laka River, Ngami-land.

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XXIV.—*Two new Rock-Wallabies (Petrogale) discovered by Capt. G. W. Wilkins in Northern Australia.* By OLD-FIELD THOMAS.

DURING the expedition recently made into Northern Australia by Capt. G. W. Wilkins examples of two species of rock-wallaby were obtained, and these prove both to be new to Science.

The first and most striking of them I propose to name in honour of the captor, to whose hard work and exploring ability our National Museum owes a very fine collection of Australian Mammals.

*Petrogale wilkinsi*, sp. n.

A medium-sized species with yellowish limbs and a conspicuous yellowish shoulder stripe.

Size about as in *P. brachyotis*. General colour above grizzled drabby grey with a vinaceous tinge, uniform to the tail, without rump-patch. Under surface from chin to anus rich buffy, the hairs on the throat and chest buffy to the roots, those on the belly broadly slaty for their basal halves. Face pale vinaceous-brown, without markings of any sort, such as lighter or darker patches above or behind the eyes. Median dark line well defined on the crown and nape, but disappearing level with the shoulders. Ears short, their backs pale brown, uniform with the face, not darkening terminally, their edges dull whitish or buffy. Shoulders rather darker than the general colour; then behind them, in a position corresponding to the white line found in *penicillata* and other species, there is a broad and conspicuous yellowish band, approximately "warm buff," about three inches in length and one in breadth. Above and in front of the hip an inconspicuous dark buffy band; and behind each hip a dark buffy patch. Forearms pale cinnamon-brown, rather paler than the face. Hands slightly darker, but not becoming black terminally. Hind legs pale cinnamon, darker, but not black, on the toes, though there are a few black hairs at the bases of the claws. Tail grizzled cinnamon-brown above, darkening to black for the terminal three or four inches; under surface and area behind anus paler buffy cinnamon.

Skull without marked characteristics, its general proportions about as in *P. brachyotis*.

Dimensions of the type:—

Head and body 490 mm.; tail 490; hind foot 140; ear 65.

Skull: greatest length 99; condylo-basal length 91; zygomatic breadth 51; nasals  $40 \times 14$ ; intertemporal breadth 11.5; diastema 15.5; upper tooth-series 31.5; length of secator 6.7.

*Hab.* Roper River, Northern Territory (Mission Station). About  $15^{\circ}$  S. and  $135^{\circ}$  E. Altitude 200 feet.

*Type.* Adult male—*m*<sup>4</sup> in position, but unworn. B.M. no. 25.12.3.1. Original number 725. Collected 4th April, 1925, by Capt. G. H. Wilkins.

This remarkably handsome rock-kangaroo is at once distinguishable from all others by its conspicuous buffy



shoulder-stripe, the known species either having this stripe white or else having none at all. Its buffy under surface, pale cinnamon limbs, unmarked head, and pale ear-backs are also characteristic.

It may perhaps be related to *P. celeris*, Le Souef\*, from S.W. Queensland, but is separable by the various colour-details above described.

The second species is from the hitherto unexplored Groote Eylandt in the Gulf of Carpentaria, and may be called

*Petrogale longmani*, sp. n.

A small ashy-grey species of the *P. penicillata* group. Feet not darker terminally.

Size less than in other species. General colour above coarsely grizzled grey, with but very slight drabby tinge, becoming clearer grey posteriorly. Under surface grey, the hairs slaty at base, pale buffy terminally, those on a small area on the throat buffy-whitish to the roots. Head pale cinnamon-brown without eye-markings, but the median dark band commences between the eyes, broadens on the crown, and passes down the nape to the withers. Ears short, their backs grey, slightly buffy proximally, not darkening terminally, the edges white. Shoulders, as in *P. penicillata*, with a marked black patch behind each upper arm, succeeded behind by an equally large white patch, which is continued, less distinct, down each side. Above, and again behind, each hip a whitish-grey patch. Forearms pale cinnamon-brown, the hands darker, but only black on the ends of the fingers. Legs buffy greyish; feet pale cinnamon to the ends of the digits, without terminal blackening. Tail grizzled greyish with a buffy tinge above, the usual terminal blackening extending in a narrow line nearly from the base; under surface pale glossy cinnamon-brown.

Skull small, delicate, with slender muzzle.

Dimensions of the type (sub-adult):—

Head and body 400 mm.; tail 340; hind foot 113; ear 47.

Skull: greatest length 89; condylo-basal length 83; zygomatic breadth 46; nasals  $39 \times 15$ ; interorbital breadth 15.3; intertemporal breadth 12; diastema 18; length of secutor 6.7.

\* 'Australian Zoologist,' iii. pt. vii. p. 273 (1924).

*Hab.* Groote Eylandt, off the Northern Territory of Australia. 200 feet.

*Type.* Subadult male, the secator up and in use, but the last molar still below the gum. B.M. no. 25.12.3.2. Original number 721. Collected 9th March, 1925.

This very pretty little island species is readily recognisable by a number of colour-details, among which may be specially mentioned its pale ashy-grey back, far paler than in any known form, its grey ears, and pale cinnamon feet without terminal darkening.

From *P. purpureicollis*, Le Souef, *P. longmani* is in turn separable by its pale general colour, absence of face markings, light muzzle, uniform grey ear-backs, and white lateral patch.

I have great pleasure in naming the species in honour of my friend and correspondent, Dr. Heber Longman, of the Queensland Museum, Brisbane, to whom Capt. Wilkins has been indebted for most material help in carrying out the arduous duties of his expedition.

#### XXV.—*A new Species of Dik-Dik (Rhynchotragus).*

By R. I. Pocock, F.R.S.

IN 1917 Mr. Arnold Hodson saw on Mt. Mega in S. Abyssinia a dik-dik so conspicuously white in colour that he regarded it as a freak of no particular interest. But on returning three years later to the same spot he noticed dik-diks to all appearance precisely similar to it on different parts of the mountain. Convinced that the antelope was an undescribed form, he shot an adult buck, and sent its skin and skull to the Natural History Museum. It was considered, however, that the evidence supplied by a single specimen was scarcely sufficient to warrant the acceptance of Mr. Hodson's opinion; and the specimen was put aside pending the arrival of additional material confirming or refuting the idea that the form is worth nominal distinction.

This was supplied in the autumn of last year by Capt. Fowler, who brought back from Mount Mega a couple of skins similar in colour to the one Mr. Arnold Hodson secured five years ago. Capt. Fowler, moreover, noticed, as Mr. Hodson had done, that these pale dik-diks were not

found in company with those of the ordinary type of coloration.

On this evidence I propose to describe the form as new, dedicating it to its discoverer, Mr. Arnold Hodson.

*Rhynchotragus hodsoni*, sp. n.

A dik-dik of the *R. guentheri* type, as shown by its skull, which is indistinguishable from the skull of that species; but differing from it and all previously recorded species in the general pallor of its pelage, which is greyish or creamy white, the hairs lacking the speckled or ticked appearance seen in other forms of the genus. But sparsely interspersed with the pallid hairs are hairs blackish or brown in colour, or banded apically with black and buff. These may be more numerous in some places than others. In the type, for instance, they give a dark cast to the shoulders. In another they are specially plentiful on the tail. The head is white varied with buff. The summit of the muzzle is greyish in the type, tinted with buff in other specimens; there is a rusty stripe over the preorbital gland and the forepart of the eye, the crest is a mixture of white, black, and brown hairs, the white predominating in the front, the brown behind; the occipital area behind the tuft and between the ears is buff, and the ears are pale buff at the base and dark grey at the back.

The clear white of the belly is separated from the dirty greyish or cream-white of the flanks by a darker band mostly of buff hairs extending from the fore to the hind limb.

The legs are whitish on the outer side down to the fetlocks; but the inner side is rusty-buff, and this colour extends on to the front of the cannon-bone, where it is sharply defined from the white of the outer side. The pasterns and fetlocks are mostly buff, but those of the hind feet are whitish on the outer side. The hoofs and the horns are quite black.

*Loc.* Mt. Mega, Southern Abyssinia.

Type-specimen collected by Mr. A. Hodson (B.M. no. 20.9.25.1. —).

Capt. Fowler's specimens were shot at an altitude of 7000 feet.

XXVI.—On a new Subgenus of Crabro.

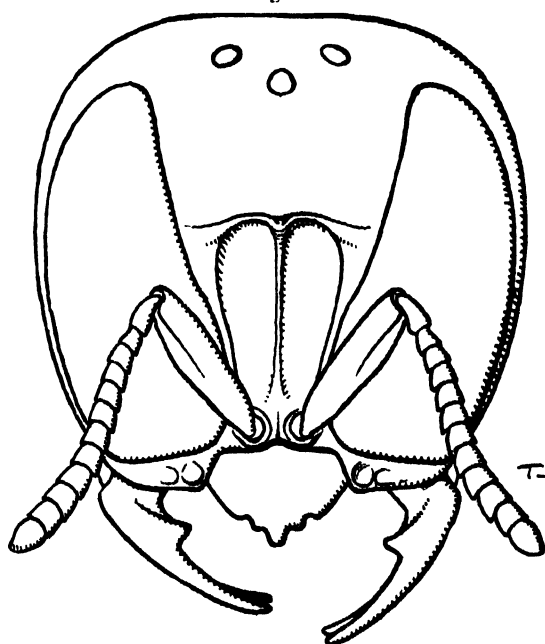
By R. E. TURNER and J. WATERSTON.

GENUS CRABRO.

Subgenus HINGSTONIOLA, nov.

♂. Antennæ thirteen-jointed; mandibles bidentate at the apex, with a small tooth on the inner margin before the middle. Head subquadrate, the ocelli in an equilateral

Fig. 1.



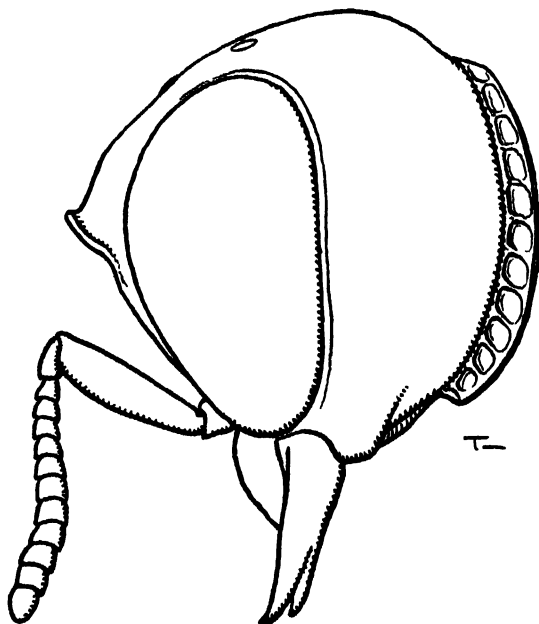
*Crabro (Hingstoniola) duplicata*, sp. n., ♂.

Head from in front.

triangle. Pronotum as broad as the mesonotum, the anterior angles produced into a sharp point. Epinenial groove for the reception of the intermediate femora very strongly developed. Median segment dorsally scarcely as long as the scutellum, abruptly truncate posteriorly. Abdomen subsessile, the first segment broader than long; the head and thorax opaque and coarsely sculptured, the abdomen

opaque, finely and closely punctured. Fore femora somewhat dilated beneath, with a spine beneath a little before the middle; joints of the fore tarsus strongly dilated, much broader than long. Apex of the radial cell truncate, forming a right angle with the radial vein. Recurrent nervure received at nearly two-thirds from the base of the cubital cell, but the angle between the cubital and transverse cubital nervures is not well defined. Maxillary palpi six-jointed, labial palpi four-jointed.

Fig. 2.



*Crabro (Hingstoniola) duplicata*, sp. n., ♂.

Head in profile.

*Crabro (Hingstoniola) duplicata*, sp. n.

♂. Niger; scapo, tergito primo macula parva apicali utrinque, pedibus anticis intermediisque, femoribus posticis supra tibiisque posticis infra flavis; tarsis anticis dilatatis fusco-marginatis; tarsis intermediis posticisque fuscis; alis hyalinis, stigmate venisque testaceis.

Long. 5 mm.

♂. Clypeus subtriangular (fig. 1), strongly carinate medially, the carina produced into a distinct tooth at the

apex, with another less distinct at each side, the whole clypeus covered with silver pubescence. Eyes separated at the base of the clypeus by a distance equal to nearly two-thirds of the length of the scape, the facets not enlarged. Frontal groove deep, strongly broadened above, finely transversely striate and with a strong median carina. Head somewhat prolonged behind the eyes (fig. 2), but not narrowed; posterior ocelli a little further from the eyes than from each other and much further from the posterior margin of the head than from each other; temples as broad as the eyes, margined behind and beneath by a strong crenulate carina; the head opaque and granulated. Thorax opaque, rather coarsely granulated, more delicately on the mesopleuræ than elsewhere, the mesoscutum posteriorly and the scutellum showing a tendency to longitudinal striæ; a transverse crenulated groove between the scutellum and the mesoscutum; postscutellum strongly longitudinally striated. Median segment margined laterally, with two longitudinal carinæ on each side on the dorsal surface, the inner pair near together and convergent towards the apex, the space between the carinæ transversely rugulose. Abdomen subopaque, finely and very closely punctured, the sides parallel. Calcar of the hind tibiæ very broad, blunt at the apex.

*Hab.* Kalimpong, Sikkim, 4000 feet, March 27, 1924 (Major R. W. G. Hingston).

Holotype (♂) in British Museum.

#### BIBLIOGRAPHICAL NOTICE.

*Birds of an Indian Village.* By DOUGLAS DEWAR. Illustrated by G. A. LEVETT-YEATS. Second Edition. Published by Humphrey Milford, Oxford University Press, 1924. Price 6s. net. Pp. 140. Printed by P. S. Shiva Rao, Bombay.

MR. DOUGLAS DEWAR has written many books, but we fear his most sympathetic critics will not be able to say that this is one of his best. Obviously the book is meant for children, and presumably for very small children, for bigger children who have had a few years in India would, we expect, have more to tell Mr. Dewar about birds than he has to tell them. A very cursory glance through the book suffices to show that the author has only the most superficial knowledge of some of the bird-life he attempts to describe. To refer to just a few of his inaccuracies. On p. 12 he talks of the "Nilkhants" choosing their mates each March; surely he must know that rollers mate for life, and keep together all the year round. If we look to see what he says about his

next bird, the king-crow, we learn that it is smaller than the bulbul, though we had always thought it to be nearly half as big again. We learn, too, that it sits on the backs of cattle in order to feed on the insects which are roused as they move about. This, no doubt, is in part true; but Mr. Dewar does not seem to have seen them picking the ticks off the hides of their host, which useful occupation is probably their principal reason for perching on their backs. Next he says that young king-crows are not so black as their parents; we thought they were just as black, but were in some cases speckled with white on certain parts of their plumage. So much for the king-crows, and we can congratulate Mr. Dewar on having accumulated so much mis-information about any one bird in the brief space of about two pages. Next to this bird the author tells us something about the oriole and explains at great length how we can tell the two common species from one another, though it would probably have sufficed if he had told his little readers that one has a black head and the other has not. He gives a single description of the eggs of orioles, including both species, apparently unaware that the one always lays pink eggs with purple-red spots and the other white ones with almost black spots. The sparrow and the crow Mr. Dewar deals with without difficulty, but when he comes to the koel he is again at sea. He says the koel might be mistaken for a crow. Probably, however, the most unobservant child would notice that the former is about two-thirds the size of the latter. Again, he says that the young koel is almost invariably spotted with white; does he not know that young koels are all black like the male and not spotted like the female? Possibly he has been reading about another cuckoo, *Surniculus*, which is exactly like the king-crow, except that it is spotted with white below. A little further on we come to some chapters on migratory birds, and in these, even if we do not learn much about birds, there is much information on other subjects—for small children. Thus we learn that birds which wish to fly from South Europe to North Africa have to cross over the Mediterranean Sea; we also learn that spaces between the higher hills of the Himalayas are called “passes.” In his remarks on birds in cages Mr. Dewar is much more interesting and his page on the Amadavat in confinement is well worth reading. The book is profusely illustrated by black-and-white sketches, but we feel that Mr. Levett-Yeats has done himself as little justice with these pictures of Indian birds as Mr. Dewar has done with his letterpress. We cannot recommend the book to anyone who wants to learn much about Indian birds, though to the casual visitor in India it may be of some use if he does not mind being addressed as if he was not very intelligent. For very small children it may possibly serve as an elementary initiation into the beauties and more simple facts about Indian bird-life. Perhaps the most useful part in the whole book is the alphabetical list of English and vernacular names; on the other hand, the column of scientific names is not of much use, as so many of the names are wrong.

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XXVII.—*Notes upon Crustacean Limbs.* By L. A. BORRADAILE,  
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[Plates VII.-X.]

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In the year 1917 I found it necessary to devote the preliminary pages of a paper (3) upon the structure and functions of the  
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mouth-parts of prawns to some remarks concerning the morphology of the limbs of Crustacea. Owing to the exigencies of war-time publication, these remarks were necessarily summary, and most of the figures which accompanied them semidiagrammatic; nevertheless, they amounted to an outline of a theory of the evolution of the appendages of the subphylum. In the main, I have seen no reason to alter the views I then put forward. In the application of them to certain appendages, however, I have come to hold different opinions; and there are other points upon which statement or comment now seems desirable. I have, therefore, put together for publication the following notes. One or two of these concern subjects which have been dealt with in papers (4, 5) published by myself since that to which allusion is made above; certain of the others relate to problems affected by the appearance of important notes by Coutière on the appendages of Arthropoda (10, 11) and the elegant work of Dr. H. J. Hansen on the segmentation of the limb (16). The illustrations have for the most part been taken in outline from the works of other authors, and are drawn in a common style for the purposes of comparison. I am under much obligation to the Authorities of the British Museum (Natural History) for affording me facilities for having them drawn.

### 1. THE PHYLLOPODIUM.

I have elsewhere (3) argued in support of the view that all the post-antennular limbs of the primitive crustacean were alike, and that they were flat structures with endites and exites. It is convenient to call such appendages "phyllopod limbs" or *phyllopodia*, whether they occur in the Phyllopoda (Branchiopoda) or elsewhere, as on the maxillary somite of the Decapoda.

It is usual to contrast this type of limb with one that is "biramous," which is sometimes held to have preceded and to have given rise to it, but that terminology is misleading. The phyllopodium has all the essentials of a biramous limb, and is sometimes strongly biramous in structure. If, for instance, comparison be made between the swimming limbs of a Eucopepod, an Argulid (Pl. X. fig. 35), and one of the Conchostraca (Pl. VIII. fig. 12), it is clear that the phyllopodium is as biramous as either of the others. In truth, the potentiality of becoming biramous, which is inherent in the plan of the crustacean limb, comes to realization independently in different cases, and not all fully biramous limbs are genetically connected as such\*. The question is not whether the

\* It may even be that the rami are not of the same origin in all cases. I have given reasons (3) for thinking it possible that the outer ramus of the trilobite limb is an epipodite rather than a true exopodite; and if that process of the trunk limb of the Anostraca which is sometimes regarded as the flabellum be in reality the apical lobe or "last endite" (see p. 198), then there is in this limb—especially when the large distal endite is directed parallel to the "flabellum"—an incipient pair of rami, formed after the manner which Lankester suggested as the general mode of origin of the exopodite and endopodite. But I think that in all the other cases discussed in this paper the exopodite is the homologue of the true flabellum and the endopodite is the axis of the limb distal to the attachment of the flabellum.

original crustacean limb possessed exopodite and endopodite, but (a) whether these members stood side by side on the distal end of a protopodite or the exopodite was borne laterally upon an axis of which the distal part constituted the endopodite, (b) whether, in addition to the exopodite and to the other exite or exites (epipodites) which the limb pretty certainly bore, there was on the median side a series of endites, and (c) whether the limb was subcylindrical or flat.

It is an important fact, and one that lends much support to the hypothesis of the primitiveness of the phyllopodium, that in respect of each of these features the condition of the leaf-like limb is independently present in many of the so-called "biramous" type. In fact, a perfectly "biramous" limb—with endopodite and exopodite subequal and borne distally upon a protopodite, complete absence of endites, and subcylindrical form—is rare, and when found is seldom the possession of crustaceans which are primitive in other respects.

## 2. ENDITES AND THE SEGMENTATION OF THE LIMB.

The axis of such phyllopodia as now exist is either unsegmented or segmented only by the presence on each surface of a number of irregular sclerites lying across its width, sometimes in transverse rows of two or three, often differing on the two sides of the limb, arranged according to a merism which corresponds generally, but as a rule not exactly, with that of the endites [Pl. VII. fig. 8; Pl. VIII. fig. 17; Pl. X. figs. 82 & 83. Hansen (16) figures various other examples]. There is no evidence for the assumption that these irregular systems of sclerites are reducible exactly to a common type, or that each of them is the remains of an original series of complete and subsimilar segments. I believe that they may best be accounted for by the hypothesis that the primitive limb was unsegmented, save by the presence of the endites, and without marked thickenings of the cuticle, and that in the course of the evolution from it of the existing limbs there was developed in most cases a system of sclerites, in the form of stronger cuticular coverings upon the endites and a number of pieces upon the sides of the limb, the sclerosis varying in detail according to the exigencies of the movements which the limb was required to perform. Upon this hypothesis, the transverse joints which separated the pieces and allowed flexion of the limb would of necessity be situated between the endites, and might exist between each of these and its neighbours (Pl. VII. fig. 3). Often, however, between two endites a joint did not arise, or failed to extend across the axis, so that one segment of the latter corresponded to two or more endites (Pl. VII. figs. 2, 5, 8; Pl. VIII. fig. 13; Pl. IX. figs. 20, 24, etc.). In the basal segment of the limb the chitinization was often defective, and here there is sometimes a gap between the sclerite of the axis and that of the endite. In such cases the latter has tended to join or be articulated to a sclerite on the succeeding segment, so that in another way one

sclerite of the axis has come to bear two endites (Pl. X. fig. 33). If upon occasion two transverse joints arose in a gap formed by the elongation of the axis between two endites, there would appear a segment to which no endite would correspond. In one case at least (*Apus*), something of this sort seems to have happened.

In those limbs which presently departed from the flat type and became narrower, stouter, and usually subcylindrical, the sclerites assumed the form of a series of rings, probably corresponding in number to the endites, though perhaps in some cases there has never been a separation between the segments of two adjacent endites. The incomplete segments which Dr. Hansen has demonstrated in some such limbs are probably truly vestigial—that is, due to the reduction of formerly complete rings. In the process of narrowing, the endites disappeared—at least, from the distal members of the series of segments.

The primitive merism of the limb is, on this view, that of the endites, not that of the joints. This, of course, is not to say that the existing series of endites of any limb corresponds exactly with the ancestral series. Very obviously it has often lost members, sometimes terminal and sometimes interstitial; partial fusion appears sometimes to have taken place; and conceivably (though of this there is no convincing evidence) an endite may sometimes have become cleft into two or more. The series of endites, like that of the joints, has undergone very great and baffling transformations in the various limbs; but of the two it is primarily the endite-series, and only thereafter the joint-series, that affords a basis for comparisons. When, for instance, to two endites there corresponds only a single transverse sclerite of the axis, to say that the two primary segments of the limb are here not separate is more likely to indicate a true comparison with other limbs than to say that a given actual segment bears two endites (or a cleft endite), however empirically true the latter statement be.

The number of members—that is, of endites, and of segments when the axis was correspondingly segmented—which existed in the limb of primitive Crustacea is, of course, a highly problematical question. But the full number of segments in the Malacostracan limb is nine\*, and a study of the maxillæ of various members of that group† shows that eight of these segments represent endites, while the ninth is the apical remainder of the limb. Moreover, it is suggestive that the same total is indicated by the endites and segments, taken together, in the maxillæ of the Copepoda *Gymnoplea*‡. On these grounds I proposed in 1917 hypothetically to assign to

\* The nine segments, which are rarely all recognizable in the same limb, are: the pleuropodite or precoxa, coxopodite, basipodite, metabasipodite or preischiopodite, ischiopodite, meropodite, carpopodite, propodite, and dactylopodite.

† (3); see also p. 201 below.

‡ See below. Dr. Hansen's elucidation of this appendage corrects in some respects that which I attempted in 1917. He finds only eight joints, but the third of these bears two endites, and, therefore, on the hypothesis advanced in the foregoing paragraphs, represents two primary segments.

the primitive crustacean limb this number of members. Limbs with a smaller number are in that respect less typical, and have presumably undergone reduction. Those with a higher number owe that condition to the subdivision of one of the primary segments.

### 3. THE ENDITES OF THE BRANCHIOPODA.

The discussion of the homologies of these structures has hitherto proceeded as an attempt to reduce the arrangements in the several Orders to a type common to the Class, which has generally been supposed to have six endites as in Notostraca. In the following paragraphs the problem is attacked from a different point of view, by an endeavour to relate the condition of the limbs in each Order separately to the type mentioned above, which is assumed to be ancestral to the Crustacea as a whole.

The longest series of endites is found, among Branchiopoda, in the Anostraca. Figures and descriptions of the appendages of a large number of members of this group are given in Daday's Monograph (12). The trunk limbs (Pl. VIII. fig. 10), with the exception of the last pair, have a long proximal endite with a deep and regular fringe of close-set hairs, a shorter succeeding endite along which the fringe is continued, three small endites bearing tufts of hairs of various lengths, and a very large distal endite with a short and sparse fringe. The distal endite is sometimes emarginate or (*Dendrocephalus*) produced into lobes, but not so as to suggest that it is compounded of two or more primary endites. The limbs of the last pair (Pl. VII. fig. 9) show a different condition. Here, though the distal endite is still by far the largest, there is much less disparity between the members of the series, and the limb presents, in respect of its endites, an appearance which recalls the larval trunk limbs of *Branchipus* and *Apus* and the early larval maxillæ of Penæidea. Most significant is the fact that the long proximal endite of the other limbs is, in a number of species belonging to different and unrelated genera, replaced on the last limb by a pair of endites subsimilar to the rest\*.

We have thus a series of seven endites. A comparison of the ordinary trunk limbs of Anostraca with those of Conchostraca (Pl. VIII. figs. 11-18) suggests that at the proximal end of this series there formerly stood a differentiated member, the gnathobase. In the Conchostraca there is a series of deep-fringed endites, certain proximal members of which tend to run together to form a long lobe which strongly recalls that of the Anostraca, but this is preceded by a first endite or gnathobase corresponding to those of the Notostraca and various Cladocera—and, indeed, of many other arthropod limbs. It is hard to resist the conclusion that in this

\* In a passage which is rather obscure, Ekman (13) appears to state that in *Polyartemia* the long proximal endite of the trunk limbs develops by the fusion of two endites, which are distinct in the larva.

respect the Anostraca bear to the Conchostraca the same relation that *Daphnia* (Pl. VIII. fig. 16) and other genera bear to *Sida* (Pl. VIII. fig. 14) among the Cladocera Calyptomera. In all these Branchiopoda a deep fringe has developed along the inner edge of certain of the limbs: in all there is a tendency to fusion of endites in the region of the fringe, the fusion proceeding further in the Cladocera than in the other groups. The Conchostraca and *Sida* retain the gnathobase proximal to the fringe. Anostraca and *Daphnia* have lost it. Whether in Anostraca it has altogether disappeared, or has become merged into the long proximal endite as one of the two components from which we have seen reason to believe that endite to have arisen, there is no decisive evidence\*.

We have thus located in the trunk limbs of the Anostraca seven, at least, of the nine lobes of the hypothetical primitive phyllopod limb. Possibly we can add to these one more, the homologue of the apical lobe, which is the ninth member of the primitive series. At the end of the outer border of the limb stands a sharply articulated, subterminal appendage, which has been regarded by some authors (Giesbrecht, Thiele, Ekman, Daday, Hansen) as a flabellum (exopodite), and by others (Claus, Gerstaecker, Lankester, Packard, Sars, and myself) as corresponding to the so-called last "endite" in the Conchostraca and Notostraca, which differs in shape from the other endites, has a clear transverse articulation, and is better described as the articulated apical portion of the limb. Calman (6), in his figure, labels the articulated appendage of the Anostracan limb as the flabellum, but in his text he holds the balance between that homology and the view which regards the appendage in question as a "sixth endite." He points out that, whereas in the development of the limb of *Apus* (Pl. VIII. fig. 18) the flabellum only appears after the endites have become marked off, the formation of the distal appendage of the phyllopodium of Anostraca (*Branchipus*) is the first differentiation to take place in the limb-rudiment (Pl. IX. fig. 19)†. On the other hand, it must be admitted that, according to descriptions of the development of *Apus* and Conchostraca‡, the apical "endite" is not in these groups precociously developed like the articulated lobe of Anostraca, but arises along with the endites. The question must remain *sub judice* until further evidence be forthcoming.

The trunk limbs of the Conchostraca (Pl. VIII. figs. 11-13) present a series of five endites §, beginning with a gnathobase and

\* In Daday's figures of the last trunk limb of Anostraca there is sometimes a proximal portion of the inner edge without an endite. Very possibly the presence of this region in the specimen drawn depends upon the accident of the completeness with which it was removed from the body. It is perhaps also significant that in one or two species (*Branchiopodopsis wolfi*, *Tinnymastis perrieri*) there is here a projection in series with the endites. Possibly this represents the gnathobase.

† See Claus (7).

‡ Sars (20). In *Estheria packardii* the endites appear before the exites.

§ The possibility, mentioned in my former paper, that the second of these lobes, which is often elongate, might represent two endites, appears to be excluded by conditions in other species, and especially in the embryo (Sars, 19, pl. vii. fig. 6).

followed by a sixth member, which is the articulated apex of the limb. The prehensile limbs of the male have a distal subquadrate joint, which appears to consist of the region to which the fourth and fifth endites belong. It bears a lobe of varying shape which is probably the fourth endite, the slender process, supposedly sensory in function, which is often found also on the fifth endite in succeeding limbs, and a hooked apical member. In the proximal region of these limbs of the male the second and third endites are often obsolescent or confluent.

In the Cladocera Calyptomera the segmentation of the trunk limbs is obsolescent. In *Sida* (Pl. VIII. fig. 14) there is a gnathobase, and the rest of the endites, or some of them, are represented by a continuously fringed inner edge of the limb, which proximally is separated by a notch from the gnathobase and distally shows indications of three short segments. In *Daphnia*, on the third and fourth limbs (Pl. VIII. fig. 15), there is no gnathobase, but an elongate lobe which starts at some distance from the base of the limb, bears the long fine fringe, and appears to represent the second to fourth endites. Distant to this lobe is a small apical segment. In the second trunk limb (Pl. VIII. fig. 16) there is a large endite which is often called the gnathobase. Since, however, this stands some distance from the base of the limb, it is probably not the first endite (true gnathobase), but that of a more distal segment—according to Hansen, of the third. Distal to it are two small lobes which perhaps represent endites and an apical lobe. The first trunk limb has only a couple of irregular lobes in the distal region, and the fifth bears no trace of segmentation. Among the Gymnomera the Polyphemidae have but one endite, though they show the most complete set of segments in the Order, possessing six in all, if Hansen be right in attributing three to the proximal part of the limb. The endite stands on Hansen's third segment. The trunk limbs of *Leptodora* are without endites.

In the Notostraca, the trunk limbs (Pl. VIII. fig. 17) have the familiar series of six very well-formed endites, of which, as in other cases, we may hold the last to be an apical lobe. Each endite stands upon a distinct segment of the axis. Between the gnathobase and the second endite there is on the anterior face of the limb an additional sclerite, whose presence I demonstrated in 1917 (3); this, however, does not extend to the outer side of the axis. Opposite it there is a low projection of the inner margin of the limb. It was no doubt the presence of this sclerite that led Huxley (17) to describe a joint here, and the possibility certainly exists that it may represent a primary segment in process of exclamation. Hansen dismisses the problem by the consideration that the suture between it and the sclerite of the first segment becomes in the first two trunk limbs nearly parallel to the axis. But a similar shifting not infrequently takes place in the boundaries of undoubted segments of arthropod limbs, as, for instance, in the anterior boundary of the basipodite (probasipodite) of the legs of *Anaspides*; and those limbs of *Apus* in which it occurs are in other respects highly

modified from the condition of the rest of the trunk series. On the whole, however, it seems most probable that the sclerite in question is an intercalary one, of the kind mentioned above.

To sum up. In the Anostraca there is evidence of the existence of seven or more of the nine primary segments, though the first endite is no longer recognizable; the highest number discoverable in the Conchostraca and Cladocera is six—and this is probably, but not certainly, also true of the Notostraca, which *may* possess seven members. Whether it is the same six which are possessed by the latter three groups there is nothing to show, but that is the simplest assumption; and considerations connected with the presence and position of the exites (presently to be discussed) make it probable that their number is due to reduction in the distal part of the limb, and not to exclamation or fusion with the body in the proximal part.

#### 4. THE RELATION OF THE EXOPODITE TO SEGMENTS OF THE LIMB.

Exites are borne only upon the proximal half of the crustacean limb. The most distal of them is the *exopodite*, which is now recognized in the "flabellum" of the phyllopod appendage\*. The flabella of the Conchostraca and Notostraca (Pl. VIII. figs. 11-13, 17), the exopodite of the Decapod maxilla (Pl. VII. figs. 1-7; Pl. X. fig. 83), and that of the swimming limbs of the Branchiura (Pl. X. fig. 85) overhang both distally and proximally their attachments to the axis of the limb. From the fact that this condition is so widespread, we may perhaps conclude that it is primitive. It supports strongly the view that the exopodite is essentially an appendage of the outer side of the limb, not one of the branches of a distal dichotomy.

The phyllopodia of the Anostraca are, as we have seen, possibly without exopodite. In those of the Conchostraca (Pl. VIII. figs. 11-13), which are unjointed, the attachment of the flabellum, often very wide, has an indeterminate extension on the proximal part of the limb, standing in different species, according to the figures of various authors (Packard, Sars, Hansen, etc.), opposite the second, third, and fourth, or second and third, or third and fourth endites. In the maxillæ of the Malacostraca and Gymnoplea the exopodite, when present [Leptostraca, Mysidacea, Cumacea, Eucarida (Pl. VII. figs. 1-7; Pl. X. fig. 83), perhaps Calanidæ† (Pl. VII. fig. 8)], is placed opposite a pair of lobes which appear to be the third and fourth of a series. Nearly always, however, the axis is more or less segmented and bears the two lobes in question upon a single segment. When the exopodite is absent, this segment with its lobes is still recognizable. Hansen regards the lobes as arising by the cleavage of a single endite, which is that of the third segment of the limb; but this view appears to be negatived by the

\* See (3), p. 49.

† See below, p. 210.

condition found in the maxillæ of larval Penæidea (Pl. VII. figs. 1-4). In the later stages [*Mysis* of *Penæus* (Claus, 8, 9), *Acanthosoma* of *Sergestes* (Hansen, 16), *Cerataspis* (Boas, 5)] these limbs have a full series of nine segments, indicated by endites throughout or (*Acanthosoma*, Pl. VII. figs. 2, 3) in the distal region only by joints with slight projections. In each case the two endites against which the endopodite stands are present as members of the series. In the zoea stage (Pl. VII. fig. 4) the distal part of the series is only beginning to be formed, and is often incomplete, but the equivalence of the third and fourth endites to the rest is still more obvious, the sharp contrast in size between the four basal endites and the rest, which in the later larvæ foreshows the adult condition, not yet existing. The first and second maxillipeds of the zoea of *Sergestes* present the same features. The larval maxillæ of various higher Decapoda (Pl. VII. figs. 5-7) show in varying degrees a reduction in the number of members of the series.

The same connection of the exopodite with two segments is found in the absence of endites in the thoracic limbs of *Nebalia* (Pl. IX. figs. 25, 26). Here, as I have shown (3), the number of segments which are formed in the endopodite varies with the limb and with the age and sex of the individual. Nearly always the four distal segments can be made out, and a fifth is often to be found proximal to them, leaving a long segment which bears the exopodite and is always clearly marked off from the coxopodite. Across the long segment, distal to the exopodite, there occasionally appears an additional joint, the faintest of the series, indicating the double nature of the segment. In *Paranebalia*, according to Hansen's recent description, this joint appears to be present but incomplete.

These instances appear to establish the existence of a tendency of that region of the axis to which the third and fourth endites belong to remain undivided and to form a double segment which, primitively, bears the exopodite. In other cases, however, this region may be seen to be divided into two segments, to one of which the exopodite, if present, is attached. The maxilla of the *Acanthosoma* is an excellent example of this. According to Hansen, in the *Acanthosoma* of *Sergestes corniculum* (Pl. VII. fig. 2) a suture proceeds from the incision between the endites halfway across the limb, while in that of *S. arcticus* (Pl. VII. fig. 3) the separation between the segments of the two endites is complete. In this instance the exopodite is attached to the more distal of the two segments\*. In the Leptostraca, as we have seen, similar conditions exist, but here when the double segment is severed the exopodite remains upon the proximal component. In the thoracic limbs of *Apus*, if the problematical sclerite between the gnathobase and the actual second endite be the remains of a true primary segment, the exopodite is attached to the fourth segment, as in the maxilla of *Acanthosoma*. If—as seems, on the

\* Coutière (10) cites other cases of larval Decapoda in which this occurs,



whole, more probable—we have here only an intercalary sclerite, the exopodite is on the third segment. In the maxillules of Ostracoda (Pl. IX. figs. 20–22) the segments of the third and fourth endites would seem to be severed and each often to be united to its other neighbour, the third segment to the second and the fourth to the fifth, the exopodite, when present (Polycopidae, Pl. IX. fig. 22), accompanying the fourth primary segment. A like condition appears to exist in the maxilla (“maxilliped”) of *Cypridina* (Pl. IX. fig. 24) \* and perhaps other Ostracods, and in the maxillules of the Calanidae (Pl. IX. fig. 23). In the prehensile limbs of male Conchostraca (Pl. VIII. fig. 13), with similar relations of the segments, the exopodite is present upon the section of the axis which bears the third and second endites.

In the thoracic limbs of Eumalacostraca the third and fourth segments are often present as distinct entities. *Anaspides* (Pl. IX. fig. 27) is peculiarly instructive in this respect. On the first seven thoracic somites of this genus all nine segments of the limbs are probably recognizable, though the precoxa is not a free segment, but, if Hansen be right †, lies in the thoracic wall. Only in the last pair of thoracic limbs is the total reduced to eight by the complete fusion of the third and fourth segments. *Paranaspides* resembles *Anaspides* in respect of this feature, but in *Koonunga* the two segments are fused in all the thoracic limbs. In the Peracarida (Pl. X. fig. 28), the number of limb-segments is reduced in two ways—by the complete disappearance into the thoracic wall in many cases of the precoxa and in some of the coxopodite also, and almost always by the fusion of two segments in the distal third of the limb. It is possible, however, by taking as a fixed point the “knee” or leg-flexure (between the sixth and seventh segments of the full series), to determine the position in the complete limb of each of the segments that are actually present. Thus identified, the third and fourth segments are both found to be present, and the exopodite is borne upon the third. In Eucarida the number of segments is also reduced. In the Decapoda the first segment is incorporated into the body-wall, where its presence is demonstrated by the taking up during development of the proximal part of the limb-rudiment with its gill-buds. In Euphausiacea and in most Decapoda a further loss of a segment has taken place, and the discovery by Coutière (10), in various prawns, of a vestigial fourth segment demonstrates that it is this member which is missing and that it is fused with the succeeding segment (ischiopodite). The exopodite stands upon the third segment. The very peculiar thoracic limbs of the Stomatopoda bear no indication of the distinctness or fusion of the third

\* But not if Hansen's account of the segmentation of this limb, based upon an examination of *Gigantocypris*, be correct. The very distal position of the small external process, called by Hansen the “exopodite,” makes its homology with that exite unlikely. Dr. H. G. Cannon has recently shown that the maxillary gland is developed in the somite of this appendage, which is therefore not a maxilliped, but the maxilla.

† See below, p. 211.

and fourth segments. Hansen states that the fourth segment ("preischium") is fused with that which succeeds it, but he gives no proof of this statement.

The antenna of the Malacostraca (Pl. X. fig. 29) probably offers another instance of the presence of the third and fourth segments as distinct members of the limb. If we assume, as perhaps we may, that the flagellum has been formed by the dissolution into a multi-articulate condition of the three segments which stand beyond that articulation at which in the legs the principal flexure takes place, then the six segments which constitute the peduncle in the typical Malacostracan antenna are the proximal six segments of the complete limb. Of these the third bears the exopodite, and the fourth, though small, is usually distinct. In the Decapoda this arrangement is obscured by the facts (*a*) that the fourth segment is usually separated from the third by a sublongitudinal instead of a transverse articulation, and (*b*) that the first segment has disappeared, as in some other cases (Tanaidacea, some Isopoda, Euphausiacea). Though there is nothing to show what has become of this segment, the actual proximal member of the limb is betrayed as the true second segment by the presence upon it of the opening of the green gland\*.

If the conclusions in the foregoing paragraphs be justified, it appears that the exopodite stands upon the third and fourth segments of the primitive limb when these segments are not parted by an articulation, and that when they are so parted it may stand upon either of them, but usually stands upon the third. The term *basipodite*, applied to the actual segment upon which the exopodite stands in any limb, has thus only an empirical significance, and I have therefore proposed (3) certain terms to distinguish the various members of the limb which are known by this name. The third segment is the *probasipodite*: the fourth is the *metabasi-podite*†. A double segment compounded of these two is a *sym-basi-podite*: either of them, when it alone bears the exopodite, is a *hemibasi-podite*. The basipodal structure, which appears sometimes, as in the maxillule of certain Polycopidæ, to arise by the union of the fourth and fifth segments, may be termed an *allobasi-podite*.

## 5. THE PROTOPODITE.

From the foregoing considerations it is evident that the recognition of a three-segmented protopodite in the Crustacea is purely empirical, for the actual third segment is not homologous in all cases, being sometimes the third segment of the primary series, sometimes compounded of the third and fourth, sometimes the fourth alone, and probably in a few instances compounded of the fourth and fifth, the actual second segment in the latter two cases being compounded of the primary second and third. The exopodite, when present, is nearly always upon the actual third

\* See Borradaile (4, p. 334) and Hansen (16).

† *Preischipodite* of Coulière (10).

segment, but in the *Acanthosoma* of *Sergestes arcticus* (Pl. VII. fig. 3) it is upon the fourth, so that the protopodite consists of four segments. A protopodite may, of course, come to consist of two actual segments or even of one, but it never comprises fewer than three primary segments.

#### 6. EPIPODITES.

The homologies of the more proximal exites—the *epipodites*, in the widest sense of that term—are more obscure than those of the *exopodite*. The occurrence of two epipodites is so widespread that we must attribute to the ancestral limb at least that number, and possibly more. But there are indications that during the evolution of the subphylum new exites of this kind have appeared, by branching and division of the original two and perhaps also by meristic repetition.

In the trunk-limbs of the Conchostraca and Notostraca (Pl. VIII. figs. 11–13, 17) there stands, immediately at the base of the flabellum and proximal to it, a single epipodite—the “branchia,”—thin-walled, vesicular, and varying in shape but usually elongate. In the Anostraca (Pl. VII. fig. 9; Pl. VIII. fig. 10) there may be recognized, in a similar position to the branchia of the Notostraca and Conchostraca, but at some distance from the structure which has been supposed to represent the flabellum, an elongate vesicular epipodite which clearly corresponds to that of the groups just mentioned. Proximal to this again there is in some genera (*Branchipus*, *Artemia*, *Streptocephalus*, etc.) a plate-like structure whose edge is usually scalloped in a characteristic manner. This is also, by definition, an “epipodite,” and has been called the *proepipodite* to distinguish it from the more distal epipodite, which we will call the *metepipodite*, both here and wherever else it may be recognized. But in other Anostraca [*Polyartemia*, *Chirocephalus* (Pl. VIII. fig. 10), *Branchinecta*, etc.] there are, in place of the single proepipodite, two similar but smaller plate-like structures. Daday (12) thinks that in the Anostraca which have a single proepipodite that structure represents one of the two of *Chirocephalus*, etc., standing in the place of the pair, the other being absent. In some cases, however (*Chirocephalus altaticus*, *C. bairdi*, etc.), there are two proepipodites incompletely divided at their base, from which it seems more probable that, as Hansen suggests, the single plate of *Branchipus* represents both those of *Chirocephalus*. Whether we are to regard the latter structures as formed from the former by division, or as forming it by fusion is an open question. But, since there are instances, as in the Lophogastridae, in which a proximal epipodite is undoubtedly cleft into branches; and since also, in those Anostraca which have upon the majority of their trunk-limbs two proepipodites, the last limb, which is rudimentary and does not show the high specialization of the others, often bears a single narrow proepipodite, which may be notched at the tip, it seems upon the whole more likely that the primitive condition is that in which there is but one proepipodite, and that the

condition in which two of these structures are present is derived from the primitive condition by division of the proepipodite.

In most of the trunk-limbs of Cladocera *Calyptomera* (Pl. VIII. figs. 14, 15) metepipodite and proepipodite are both recognizable. In many other crustacean limbs one or more epipodites are present, but their structural features are very diverse, and their morphological relations, among themselves and with the epipodites of the Branchiopoda, can only be decided if it be possible to establish categories of these structures by means of some constant relation to the primitive segmentation of the limb. That we must now endeavour to do.

In the trunk-limbs of the Anostraca, where the axis is unsegmented and the exopodite either much displaced distally or entirely absent, leaving vacant its normal site opposite the third and fourth endites, the wide bases of all the epipodites appear from the figures of various authors to differ considerably in position, and in any case to be more distally placed than those of other Crustacea. In the other Branchiopoda the metepipodite is always upon the second segment of the limb, as indicated by endites or sutures\*. In the Cladocera, where epipodites of both categories are present, the proepipodite is upon the first segment.

The maxillule of *Calanus* (Pl. IX. fig. 23) possesses a large proximal and a small distal epipodite. The former of these stands opposite the first endite and the latter opposite the second endite. It seems probable that these represent the proepipodite and metepipodite of the other Branchiopoda. The same may be said of the two filamentary appendages borne by the first and second segments of the foremost cirrus of some Cirripedia.

On thoracic limbs of the Lophogastridæ and Decapoda we again meet with more than one epipodite. The proximal of these is in the Lophogastridæ a branched gill, which has been shown by Hansen to stand upon a vestigial precoxæ. In Decapoda it is represented, according to the hypothesis put forward by Coutière, by two gills—the pleurobranchia and posterior arthrobranchia—which were first shown by Claus (9) to originate upon a basal segment of the limb which is taken into the thoracic wall during development. On account of its position this epipodite may be regarded as a proepipodite which, like that of the Anostraca, shows a tendency to more or less complete division. The more distal epipodite stands upon the second segment (coxopodite). In the Lophogastridæ it forms the oostegite, and Coutière regards the setiferous tubercle (setobranchia, 2) as derived from it. In the Decapoda this distal epipodite may be represented, upon my modification (2) of Coutière's theory, by one, some, or all of four structures—the mastigobranchia, podobranchia, anterior arthrobranchia, and setobranchia. The first-named two of these proclaim

\* This statement is true of the Notostraca on either of the views of its segmentation which have been stated above, for if the problematical sclerite represents a second segment it fails to reach the outer side of the limb, leaving the first and third to meet in its place, and the epipodite stands upon the membrane which joins them, though mainly opposite the third.

their common origin by occurring in union, developed from a common rudiment. Whether the others be derived from the same ancestral structure by division, as the above-stated theory supposes, or have arisen independently by meristic repetition, there is in truth nothing to show. The occurrence in a species of *Eiconaxius* \* of a second podobranchia inserted upon, or very close to, the setobranchia shows how easily epipodial structures may be multiplied.

In *Anaspides* (Pl. IX. fig. 27) we meet again with two epipodites. Here, if Hansen's recognition of certain portions of the thoracic terga as precoxæ be just, both epipodites stand upon the coxa, and we are faced, as in Decapoda, with the alternatives of division and repetition. Those thoracic limbs of Amphipoda which bear both an oostegite and a gill (Pl. X. fig. 28) present the same problem.

What these facts amount to is that epipodial structures may occur both upon the first and upon the second segment of the limb, and that when there are only two such structures most often one is upon each of these segments and they are unlike. Further, there is clearly a tendency for them to divide, and this makes possible the simplifying hypothesis that primitively there were but two of them—the proepipodite upon the first segment and the metepipodite upon the second.

In a further series of cases a limb bears a single epipodite, which we may call proepipodite or metepipodite according as it stands on the first or the second segment. Thus, the metepipodite alone appears to be present on the first and second trunk-limbs of *Daphnia* (Pl. VIII. fig. 16), on various maxillules of Ostracoda (Pl. IX. figs. 20, 21) according to Hansen's view, on the thoracic limbs of Leptostraca (Pl. IX. fig. 25), and on certain of those of Peracarida †, while it is probably the proepipodite that is present alone on various maxillæ of Ostracoda and thoracic limbs of Cirripedia ‡ and Stomatopoda. In no instance does any structure which can be regarded as an epipodite stand on a segment distal to the second.

## 7. NOTES ON MANDIBLES.

### (a) *The Palp in Polyartemia.*

Hansen (16) describes the mandibles of Branchiopoda as being without palp. This statement is no doubt true of the majority of members of the Class, but it ignores Ekman's discovery (13),

\* Coutière, C. R. Soc. Biol. Paris, lxiv, p. 540 (1908). In this paper Coutière regards the anterior arthrobranchia as a derivation of the proepipodite.

† On the maxillipeds of all Orders except Amphipoda and as oostegites on various legs. The oostegites, like the gills of Amphipoda, are, of course, on the inner side of the limb, but are generally regarded as epipodial.

‡ Similar structures sometimes stand on the side of the body at a distance from the cirri. Whether these be migrated epipodites or homoplastic organs does not appear.

which I am able to confirm, that a small palp is present in at least some species of *Polyartemia*.

(b) *The Mandible of Cirripedia.*

The mandibles of the barnacles (Pl. X. fig. 30) are quite unlike those of any other Crustacea. They are two-jointed, and bear the biting process on the second segment. This process, moreover, is a thin, toothed blade, very different from the broad-ended structures which manipulate the food in other mandibles. On these grounds, I suggested in 1917 (3) that in the cirripede mandible it was not as in other Crustacea the true gnathobase, but the second endite that had persisted as the masticatory process. Hansen is also struck by the fact that the mandible of Cirripedia has a segment proximal to the biting process, and he founds upon it a suggestion that this limb is not a true mandible but the maxillule. He is thus obliged to regard the maxillule as the maxilla and the maxilla as one of the paragnatha. In order to hold this view, it would be necessary to assume that the opening of the excretory gland has migrated from the maxilla, the latter remaining present, and located itself upon the paragnathum—an assumption that will probably not commend itself to carcinologists. On the other hand, in the mandibles of the Halocypridæ (Pl. X. fig. 31) one of the distal endites (standing, according to Hansen, upon the third segment) forms a part, and often the greater part, of the biting process. If here the gnathobase entirely disappeared, we should have a condition which would resemble that which occurs in the Cirripedia.

It is also possible that the apparent second segment is not truly metameric with the first, but is an expansion of the sclerite which caps the gnathobase, articulating with its axial sclerite, as the sclerites of endites not infrequently do.

I agree with Hansen that the sclerosis of the palp probably represents a segment distal to that which bears the endite. In *Balanus* a curious soft process of the palp overhangs the articulation of the endite-segment.

(c) *The Incisor Process of Malacostraca.*

The incisor process of the Malacostracan mandible is quite peculiar to this Class. It appears at the base of the group, in the Leptostraca, fully formed and entirely distinct from the molar process. In my paper of 1917 two possible modes of its origin were suggested—that it may have developed with the molar process from the gnathobase, or, like the mandible of Cirripedia, represent the second endite, that of the coxopodite. At the time I inclined, on the whole, to the latter of these hypotheses. On further consideration this preference does not seem very well founded. There are various instances, from Notostraca onwards, of flanges outstanding from the biting endite of the mandible, and the incisor

process is as likely to have arisen in this way as by union of a coxopodite bearing an endite with the precoxal. As to what has happened to the coxopodite of Malacostraca, we are still in the dark.

(d) *The Palp in Paranaspides.*

It is very desirable that this structure should be re-examined in a specimen of the maximum size, and Smith's statements (22) concerning its features in such specimens confirmed or disproved. According to Smith the species "may attain an inch in length," and "in old specimens [the palp] appears to be distinctly four-jointed, and the basal joint carries a very definite little external branch."

I have recently examined a specimen which measured .75 of an inch from rostrum to tip of telson, and .95 inch from the extremity of the antennal scale to that of the uropod. In this specimen the palp had only three joints, and, though the outer angle of the basal joint was rather prominent, there was no trace of external branch. I have already (3) reported the same results from the examination of other specimens. Professor W. M. Tattersall, to whom I am indebted for my material, kindly informs me that he has been unable to find the features described by Smith in any individual he has examined.

8. NOTES ON MAXILLULES.

(a) *The Maxillule of the Ostracoda.*

The key to the morphology of the maxillule of Ostracoda is to be found in that of *Cytherella* (Pl. IX. fig. 20). In Sars's figure (21) this appendage, which I regret not to have had the opportunity of examining, presents the aspect of a partially segmented phyllopodium, with a striking resemblance to certain larval limbs of Penaeidea and Euphausiacea. The basal segment bears three endites: Hansen finds indications of an incipient or vestigial separation of the region which carries the first from that upon which the other two stand. Distal to this is a segment which carries the fourth and fifth endites, another upon which is a single, low, sixth endite, and an apical segment. Upon the segment of the three proximal endites, and, according to Hansen, upon that part of it which bears the second and third endites\*, stands a broad fringed exite. This, by its relation to the endites, might be an exopodite or an epipodite, but, since in Polycopidae an indubitable exopodite is borne upon the succeeding segment, is probably an epipodite. In the maxillule of *Cypris* (Pl. IX. fig. 21) this disposition is found in a different form, the basal part

\* In Sars's figure, which is much more explicit in this respect than Hansen's, the epipodite stands very clearly upon the region which bears the first endite. The homologies of the epipodites of Ostracod maxillules require further investigation.

of the limb being much broadened. The exite of this limb must therefore be held to be a metepipodite, and not, as Müller thought and as I held in 1917, an exopodite. In *Polycope* (Pl. IX. fig. 22) the true first segment is more clearly separated from that which bears the second and third endites, the epipodite is lacking, and there is an exopodite on the succeeding segment, which retains a small fourth endite, and is sometimes imperfectly divided from the segment which follows it. The maxillules of *Myodocopa* are reducible to the same ground-plan as those of the other Orders, though with much variation in the width of the limb, in the exites which are present, and in the degree of segmentation of the axis.

### {(b) *The Maxillule of Calanus.*

The maxillules of a number of *Gymnoplea* are figured in Giesbrecht's monograph (14), and to judge by *Calanus finmarchicus* they are excellently represented. The interpretation of this limb (Pl. IX. fig. 23) is rendered very difficult by the irregularity of its shape, which is due to the fact that the endites and exites do not arise in regular order along edges of the limb, but project in various directions from the borders of the anterior and posterior faces. There are three well-marked endites and three exites. The first endite (gnathobase) and the first exite (proepipodite) are larger than the others, and stand upon a rather swollen basal region of the limb; the second and third endites and the second exite (metepipodite), which is small and bears only a single seta, are placed upon a narrower region beyond, the second endite standing in the furrow distal to the enlarged first segment. A groove beyond the second endite marks the beginning of a long segment—the fourth, or perhaps fourth and fifth—upon which stands the exopodite. Distally this segment bears a low setigerous internal prominence, which is perhaps the fourth endite. Beyond it are three ill-defined segments, each of which is upon the inner side prominent and provided with setæ.

### (c) *The Maxillule of Decapoda.*

In this appendage (Pl. X. fig. 32) the most external member of the transverse row of sclerites\*, which constitute the firm portion of the precoxa, is fused with that hardened section of the outer side of the limb which represents the coxopodite, to form the "articular sclerite" named in my description (5) of the maxillule of *Carcinus*. It is, however, hardly true to say, with Calman (6) and Hansen (16), that the first two segments are fused. The condition is rather that which is found in various phyllopodia [as the trunk limbs of *Notostraca*; maxillule of *Cypridina* (Hansen, 16); maxilla of *Calanus*, *Stomatopoda*, *Decapoda*, etc.], in which to each endite there correspond one or

\* In *Carcinus* four in number, including the component which is merged into the articular sclerite.



more discontinuous sclerites placed in transverse order upon the axis. In the limbs it frequently happens that upon the outer side a single sclerite corresponds (whether by non-severance or reunion) to two endites. That the sclerites which run across the limb belong, even when they are continuous with the stiffening of the endites, in great part to the axis is clearly shown by the fact that the endopodite may be borne upon one of them towards its mediad end.

The exite upon the first segment of the maxillule of various Eucarida, which was formerly called the exopodite and which I proposed to regard as a proepipodite, is treated by Hansen as a structure *sui generis*, the *pseudexopodite*, presumably because of its late appearance in the larval history. This is probably the best course to take with it.

## 9. NOTES ON MAXILLÆ.

### (a) *The Maxilla of Chirocephalus.*

The maxilla, which is at best subvestigial in Branchiopoda, has in the British species of *Chirocephalus* (*C. stagnalis*, according to Daday) almost absolutely disappeared. I was at first of opinion that no vestige of it remained, but Dr. H. G. Cannon informs me that by means of sections he has discovered that it is represented by an exceedingly small prominence (about 50  $\mu$  long in an adult male), bearing three spines rather shorter than itself, directed towards the mouth. The information may be of use to zoologists who have vainly endeavoured to demonstrate this appendage to a class.

### (b) *The Maxilla of Calanus.*

Hansen's description of this appendage in *Megacalanus princeps* corrects in various particulars previous accounts of its structure in Calanoida, including my own. I am unable, however, to see in *Calanus finmarchicus* (Pl. VII. fig. 8) all the details found by Hansen in the larger species. There appear to me to be three large segments, each bearing two endites, and therefore representing two primary segments, followed by three small segments without endites. Thus nine primary members are indicated. On the second and third segments the distal endite is separated from the body of the segment by a slanting suture. On the outer side of the second large segment, the seta which Hansen regards as a vestige of the exopodite is placed at the proximal end, not midway as in *Megacalanus*. It would appear from Hansen's figure that in *Megacalanus* the region which corresponds to the first double segment in *Calanus* possesses several sclerites, which are so disposed that the sclerite of the first endite is separated by an expanse of unthickened cuticle from its corresponding sclerite of the axis, but united to the axial sclerite which corresponds to the second endite.

(c) *The Maxilla of Decapoda.*

The sclerite system of this limb varies greatly with the shape, which in turn depends upon the disposition of the branchial passages. I am not at present prepared to put forward a definitive theory of its homologies, but I offer provisionally the following scheme:—The first segment remains largely membranous (Pl. X. fig. 33). Its endite is or is not united by stout cuticle to the axial sclerite which corresponds to the second endite. On the outer side of the base of the limb there fits a stout cap of considerable size. This is sutured to a sclerite of the body-wall, and, therefore, presumably belongs, in part at least, to the first segment of the limb. But upon its inner edge, sometimes quite near the proximal end, there abuts, without union, a sclerite which runs across the axis of the limb from the second endite. This would seem to indicate that it represents also the outer portion of the second segment. The third and fourth endites are united at their bases into a common sclerite, which continues for a longer or shorter distance across the limb. A short sclerite stands upon the outer side of the limb, distal to the basal cap. It may belong to the third segment, though Hansen, finding in *Nephropsis* a devious connection between it and the transverse sclerite of the second (and first) endite, regards it as the second segment. In that case the basal cap would belong to the first segment only, and the third segment would have no representative on the outer side of the limb. An irregular zigzag row of sclerites, comprising at least two pieces, and having in crabs an M-shape (4), crosses the limb distal to the origin of the fourth endite and bears the exopodite and endopodite. It represents, I believe, the fourth segment.

10. THE MAXILLIPED OF *CALANUS*.

The absence both of exites and endites makes the morphology of this limb exceedingly difficult. The view concerning it which was put forward in my paper of 1917 (3) still appears to me best to explain it. I believe that the three low setigerous prominences on the second actual segment (Pl. X. fig. 34) indicate that this segment comprises the second, third, and fourth primary members of the limb. That there are six segments beyond this, bringing up the total to ten, is, I believe, due to an abnormal segmentation of the distal region. There is nothing to show where the exopodite stood, but doubtless it was opposite the third or fourth endite. The protopodite therefore consists of the first two actual segments, and comprises four primary segments.

## 11. THE THORACIC PRECOXÆ OF ANASPIDIDÆ.

The areas, marked off by a depression, at the sides of the terga, which Hansen regards as representing the precoxæ, are recognizable by his description (16), not only in *Anaspides* in which he discovered them, but also in *Paranaspides*. Whether they

are indeed the first limb-segments is another question. The two internal processes of the maxilliped and the two epipodites suggest that the precoxa has fused with the coxopodite; but the internal processes are collateral, not successive, and the Decapoda supply a parallel for the existence of two metepipodites, while the taking up of the precoxæ into the thoracic wall in other Malacostraca supports Hansen's view.

## BIBLIOGRAPHY.

- (1) BOAS, J. E. V. "Studier over Decapodernes Slægtskabsforhold." Kongl. Danske Vidensk. Selsk. Skrifter, (6) i. pp. 23-210 (1880).
- (2) BORRADAILE, L. A. "On the Classification of the Decapod Crustaceans." Ann. & Mag. Nat. Hist. (7) xix. pp. 457-486 (1907).
- (3) —. "On the Structure and Function of the Mouth-parts of the Palæmonid Prawns." Proc. Zool. Soc. Lond. 1917, pp. 37-71.
- (4) —. "On the Pontoninæ." Trans. Linn. Soc. Lond. (2) xvii. 3, pp. 323-396, pls. lli.-lvii. (1917).
- (5) —. "On the Mouth-parts of the Shore Crab." Journ. Linn. Soc. Lond. xxxiv. pp. 115-142, pls. x., xi. (1922).
- (6) CALMAN, W. T. "Crustacea," in 'A Treatise on Zoology.' Ed. by Ray Lankester, part vii. (1909).
- (7) CLAUS, C. "Zur Kenntniss des Baues und der Entwicklung von *Branchipus stagnalis* und *Apus cancriformis*." Abh. k. Ges. Wiss. Göttingen, xviii. (1873).
- (8) —. "Untersuchungen zur Erforschung der Genealogischen Grundlage des Crustaceen-Systems." 4to. Vienna, 1876.
- (9) —. 'Neue Beiträge zur Morphologie der Crustaceen.'
- (10) COUTIÈRE, H. "Sur la morphologie du membre des Crustacés." Comptes rendus Ac. Sci. clxviii. pp. 1062-1064 (1919).
- (11) —. "Le membre des Arthropodes." Ibid. clxviii. pp. 1228-1230 (1919).
- (12) DADAY DE DEÉS, E. "Monographie systematique des Phyllopo des Anostracés." Ann. Sci. Nat. (9) xi. pp. 91-489 (1910).
- (13) EKMAN, S. "Beiträge zur Kenntniss der Phyllopodenfamilie Polyartemiidæ." Bih. Sv. Vet.-Ak. Handl. xxviii. iv. 11 (1902).
- (14) GIESBRECHT, W. 'Pelagische Copepoden des Golfes von Neapel.' 4to. Berlin, 1902.
- (15) HANSEN, H. J. "A Contribution to the Morphology of the Limbs and Mouth-parts of Crustaceans and Insects." Ann. & Mag. Nat. Hist. (6) xii. pp. 417-484 (1893). [Transl. from Zool. Anzeiger.]
- (16) —. 'Studies on Arthropoda.—II.' 8vo. Copenhagen, 1925.
- (17) HUXLEY, T. H. 'A Manual of the Anatomy of Invertebrated Animals.' 8vo. London, 1877.
- (18) MÜLLER, G. W. 'Die Ostracoden des Golfes von Neapel.' 4to. Berlin, 1894.
- (19) SÆVS, G. O. "On *Cyclotheria hislopi*." Christiania Vidensk. Selsk. Forhand. 1887, i.
- (20) —. 'Development of *Etheria packardii*.' 8vo. Christiania, 1896.
- (21) —. 'An Account of the Crustacea of Norway. Vol. ix. Ostracoda.' Bergen, 1922.
- (22) SMITH, G. "On the Anaspidacea, Living and Fossil." Quart. Journ. Mic. Sci. liii. (1909). 4

## EXPLANATION OF THE PLATES.

## PLATE VII.

- Fig. 1. Maxilla of *Mysis* larva of *Penæus*. After Claus.  
 Fig. 2. " *Acanthosoma* of *Sergestes corniculum*. After Hansen.  
 Fig. 3. " " *S. arcticus*. After Hansen.

- Fig. 4. Maxilla of a penoid *Zoea*. After Claus.  
 Fig. 5. " *Anisocaris*. After Ortmann.  
 Fig. 6. " *Fissocaris*. After Claus.  
 Fig. 7. " *Zoea* of *Thia*. After Claus.  
 Fig. 8. " *Calanus finmarchicus*.  
 Fig. 9. 11th trunk limb of *Pristicephalus priscus*. After Daday.

## PLATE VIII.

- Fig. 10. 6th trunk limb of *Chirocephalus* sp.  
 Fig. 11. 2nd " " female *Cyclostheria hislopi*. After Sars.  
 Fig. 12. 8th " " male *Estheria elizabethæ*. After Sars.  
 Fig. 13. 2nd " " " " " "  
 Fig. 14. 1st " " *Sida crystallina*. " "  
 Fig. 15. 3rd " " *Daphnia pulex*. " "  
 Fig. 16. 2nd " " *Daphnia magna*. After Hansen.  
 Fig. 17. 10th " " *Apus cancriformis*.  
 Fig. 18. Stages in the development of the trunk limbs of *Apus*. After Claus.

## PLATE IX.

- Fig. 19. Stages in the development of the trunk limbs of *Brachypus*. After Claus.  
 Fig. 20. Maxillule of *Cytherella abyssorum*. After Sars.  
 Fig. 21. " *Cypria* sp.  
 Fig. 22. " *Polycopse punctata*. After Sars.  
 Fig. 23. " *Calanus finmarchicus*.  
 Fig. 24. Maxilla ("maxilliped") of *Cypridina norvegica*.  
 Fig. 25. Thoracic limb of *Nebalia bipes*.  
 Fig. 26. Outline of axis of thoracic limb of old female of the same.  
 Fig. 27. Maxilliped of *Anaspides*. After Hansen.

## PLATE X.

- Fig. 28. 4th thoracic limb of female *Gammarus*.  
 Fig. 29. Peduncle of antenna of *Janira*. After Sars.  
 Fig. 30. Mandible of *Lepus anatifera*: external view with the body and palp somewhat divaricated, and posterior view of the body only.  
 Fig. 31. Mandible of *Conchocia elegans*. After Hansen.  
 Fig. 32. Maxillule of *Carcinus maenas*.  
 Fig. 33. Maxilla of *Carcinus maenas*.  
 Fig. 34. Maxilliped of *Calanus finmarchicus*.  
 Fig. 35. 2nd swimming limb of *Dolops reperta*. After Bouvier.

## Lettering on Plates.

- ap. Apical lobe.  
 br. Branchia.  
 c.pl. Coxal plate.  
 en. Endopodite.  
 end. Endite.  
 ep. Epipodite.  
 ex. Exopodite.  
 ost. Oostegite.  
 m.ep. Metepipodite.  
 m.ep.', m.ep.''. Two metepipodites upon the same limb.  
 p.ep. Proepipodite.  
 p.ep.', p.ep.''. Two proepipodites upon the same limb.  
 plp. Palp.  
 1-8. Endites or primary segments corresponding to them.

XXVIII.—*Descriptions and Records of Bees*.—CVIII.

By T. D. A. COCKERELL, University of Colorado.

*Mesonychium porteri* (Herbst).

♀.—Length about 12 mm.

Robust; head purple, with long black hair, scanty on face; labrum black, the upper part shining; antennæ black; thorax black, the posterior disc of mesothorax, scutellum, and mesopleura purple; area of metathorax black, opaque, the lower end shining; long hair of thorax entirely black; tegulæ greenish blue in front. Wings dilute fuliginous, shining purple; first recurrent nervure falling short of second intercubitus. Legs purple, with long black hairs; spur of middle leg with three minute apical spines, two very short, the other longer. Abdomen brilliant shining blue, suffused with green, first segment with long black hair.

Tingo, Peru, alt. 7275 ft., Aug. 16, 1925 (*Cockerell*).

This appears to be the *Melissa porteri* of Herbst, from near Arica, without doubt. It is closely related to *M. jenseni* (Friese), from Mendoza, but easily separated by the brilliant shining abdomen; also allied to *M. cærulescens* (Lep.), from S. Paulo, but known by the purple colours of head and thorax and the brilliant colour of the abdomen.

*Caupolicana malvacearum*, sp. n.

Closely allied to the Chilean *C. hirsuta*, Spinola, differing thus:—

♀.—More robust, face broader, third antennal joint considerably longer; thorax anterior to tegulæ with a band of black hair right across; upper part of pleura with black hair. Wings longer and more ample, stained with reddish brown, basal nervure more remote from nervulus. Legs with black hair, the scopa of hind femora black. Abdomen with long white hair on first segment, but wholly without hair-bands; white hair at extreme sides of second segment.

♂.—Third antennal joint much longer; thorax above with a very broad band of black hair from side to side, connecting with the black hair on upper part of pleura; hair on middle and hind femora black. Abdomen with long white hair on first segment and a short band of pure white hair at extreme sides of second, but no transverse bands. The abdomen has a very faint greenish tint.

Tingo, Peru, Aug. 18–22 (*Cockerell*).

Regularly visiting malvaceous flowers (*Cristaria multifida*, Cav.).

It was also seen to suck at *Lycopersicum peruvianum*. The type is a ♀.

Distinguished from *C. bicolor*, Friese, which Herbst refers to *C. hirsuta*, by the black hair of hind femora and the black band across thorax. It must also be different from *C. interrupta*, Pérez, which Herbst says represents a coast-race of *C. hirsuta*. The difference in the antennæ shows that *C. malvacearum* is a distinct species.

*Caupolicana egregia* (Friese).

Tucuman, Argentina.

Described as a variety of the Chilean *C. fulvicollis*, Spin., but better regarded as a distinct species.

*Lithurgus aterrimus*, sp. n.

♀ (type).—Length about 14.5 mm.

Black, with entirely black pubescence; wings dusky; mandibles massive, tridentate at apex, base concave; labrum with a median groove; clypeus transverse, short, coarsely punctured but shining, the punctures sparse in middle; no facial prominence; flagellum obscurely brown beneath; mesothorax shining, with strong well-separated punctures; basal nervure falling a little short of nervulus; hind spurs long, curved at end; abdomen shining. The mouth-parts are greatly elongated.

♂.—Similar, except for the usual sexual differences and the presence of a tuft of pale ochreous hair at the outer side of base of each antenna.

Tingo, Peru (type-locality), Aug. 16–22 (*W. P. Cockerell*); many specimens, all at flowers of *Opuntia*.

Also one at Yura, Peru, alt. 8450 ft., Aug. 23.

Related to *L. muticus*, Herbst, from Chile, but easily known by the entirely black hair of the female and black hair of male clypeus.

*Megachile piurensis*, Cockerell.

This was described from the male. At Paita, Aug. 28, 1925, I took six females and a male.

The female closely resembles the male, and has the hair entirely black, including that on face and ventral scopa. Compared with *H. eulalie*, Ckll., it is larger and more robust, with much darker wings, and the abdominal segments have deep transverse channels. The mandibles are quadridentate.

*Megachile chilensis*, Spinola.

This Chilean species (which I have from Santiago) extends up the coast into Peru; in 1925 I took it at Tingo, Aug. 16–22, both sexes at flowers of *Encelia canescens*; also at Yura, Aug. 23, and Tia Baya, Aug. 19. The one at Yura was on *Mesembryanthemum* flowers.

*Megachile grandibarbis*, Pérez.

Vachal records this from Arica. My wife and I took three males at Yura, Peru, Aug. 23. They were at flowers of *Marrubium vulgare*.

*Megachile flammiventris*, Vachal.

Described from Arica. I took it at Tingo, Peru, Aug. 16 and 17. It visits flowers of *Encelia canescens*.

*Megachile enceliae*, sp. n.

♀.—Length 10·5–11·5 mm.

Black, with black and white hair, the ventral scopa entirely bright ferruginous; mandibles broad, quadridentate; clypeus densely rugoso-punctate all over, with a median keel or line, the lower margin excavated in middle, with a central tooth; front entirely dull. Head with very long hair, on cheeks white, with a little black anteriorly, on vertex black, in the region about antennæ white, with black intermixed, on clypeus black, but white at sides of face; antennæ black; mesothorax and scutellum densely and finely rugoso-punctate, the former glistening in middle; hair of thorax long and dull white, mixed with black on dorsum; tegulæ black. Wings strongly smoky, the upper half of marginal cell fuliginous. Legs black with pale hair, but small joints of tarsi dark red, and tarsi with red hair on inner side; spurs ferruginous; hind basitarsi not broadened. Abdomen with white hair on first segment, and narrow entire white bands on the following four; disc of second segment with thin white hair, third to fifth with black; sixth segment straight in lateral profile.

Tingo, Peru, Aug. 16–22, 1925 (*Cockerell*).

Visits *Encelia canescens* along with *M. flammiventris*, to which it is allied, differing by the banded abdomen, white hair of pleura, &c. In Schrottky's table of Brazilian species it runs nearest to *M. parsonia*, Sky., but it is quite distinct.

*Anthidium simulans*, sp. n.

♂ (type).—Length about 13 mm. (abdomen curved downward), anterior wing 9.5 mm.

Black, with bright yellow markings, the yellow including clypeus (with or without two small black stripes above), mandibles (except the tridentate apex), spot above eye, marks at anterior corners of mesothorax and above tegulae (or the latter wanting), marks on scutellum and axillae, marks on tegulae in front and behind, spots on middle and hind knees, outer face of tibiae (partly invaded by black on hind tibiae), basitarsi (tarsi at end red), four spots on each of first six abdominal segments (lateral ones on sixth very small), and two spots on seventh segment; hair of head and thorax white, dorsally pale fulvous; antennae entirely black; eyes green. Wings fuliginous. Spurs pale reddish. Abdomen shining, sixth segment with long curved lateral spines, apex with three sharp straight spines, the middle one much shorter than the others.

♀.—Length 10.5–11 mm.

Mandibles multidentate; clypeus with a large wedge-shaped black area, its base on upper margin; lateral face-marks triangular; large cuneiform light marks above eyes; marks on mesothorax larger; yellow stripes on femora; sixth segment nearly all pale, with a median black line, its margin quadridentate; ventral scopa yellowish white. In one specimen the dark mark on clypeus is reduced to a series of spots.

Tingo, Peru, Aug. 16–22, 1925 (*Cockerell*).

It visits flowers of *Encelia canescens*. Apparently closely allied to *A. aricense*, Friese, described from the female taken at Arica, but known by the large black mark on the clypeus. The male resembles *A. 22-punctatum*, Friese, from Ecuador; but that has the apical segment of abdomen entirely black, the marks on scutellum and axillae much larger, and the face narrower. The females of the two species also differ conspicuously. *A. 22-punctatum* is perhaps not separable from *A. deceptum*, Smith.

*Anthidium paitense*, sp. n.

♂.—Similar to *A. simulans*, and at first sight appearing identical, but the end of the abdomen has broad rounded lateral lobes instead of spines. Clypeus entirely orange-yellow, yellow marks on scutellum large; sixth abdominal segment with only two yellow spots; seventh entirely black.



Paita, on the coast of Northern Peru, Aug. 28, 1925 (Cockerell).

Another relative of these species is *A. cuzcoense*, Schrottky, from Cuzco; but that has the thorax without yellow marks and the tegulæ ferruginous.

*Anthidium atricaudum*, sp. n.

♀.—Length about 12 mm.

Very robust, with long mostly black hair, but it is grey about antennæ, on thorax above (but long black hair on scutellum), on middle of cheeks, and on first abdominal segment; the pale markings are creamy-white, consisting of a spot above each eye, a rather large subpyriform spot at each side of first two abdominal segments, and small spots on third segment. Wings strongly brownish; apex of abdomen strongly quadridentate. The mandibles have six teeth.

Yura, Peru, Aug. 23 (Cockerell).

Closely related to *A. matucanense*, Ckll., of which only the male is known. It is, however, distinctly larger and more robust than *matucanense*, which is contrary to the expectation in *Anthidium*, and the markings of the abdomen are greatly reduced. It also differs in having the hair of the legs entirely black.

*Chilicola styliventris* (Fries).

Described under *Ædiscelis*, from Peru, no special locality cited. At Tingo I took two females, Aug. 22, and a male, Aug. 16. The first recurrent nervure varies from a little before to a little behind the intercubitus.

*Chilicola chalcidiformis* (Meade-Waldo).

*Idioprosopis chalcidiformis*, Meade-Waldo, from Patagonia, is closely allied to *C. plebeia*, Spinola (*vernalis*, Phil.), from Chile. I saw the male type in the British Museum; it has great hind femora, like a *Nomia*; the hind tibiæ are very broad, trigonal, bright red.

*Camptopæum maculatum*, Spinola.

*C. reedi*, Ckll., is this species, agreeing with specimens received from Dr. Herbst.

*Camptopæum* (*Acamptopæum*) *inauratum*, sp. n.

♀.—Length nearly 12 mm.

Black, without metallic lustre; broad supraclypeal marks,

large dog-ear marks, and large triangular lateral areas of clypeus pale yellow; base of mandibles with a cream-coloured spot; scape black, flagellum obscure red beneath except at base; face very broad; eyes blue-green; face, cheeks, and occiput with long white hair, vertex with black hair; mesothorax and scutellum shining; dorsum of thorax and tubercles covered with bright fulvous hair, pleura and sides of metathorax with white; tegulæ reddish testaceous. Wings faintly dusky; stigma dark ferruginous, nervures fuscous; basal nervure meeting nervulus; second cubital cell a little longer than first below, receiving recurrent nervures far from base and apex; marginal cell broadly truncate. Legs black, with dull white hair, pale fulvous on inner side of tarsi; spurs red, on middle tibiæ very long; anterior knees pale yellow; hind tibiæ with much of basal half dull white; hind basitarsi pale yellow. Abdomen shining, extremely finely punctured; no tegumentary bands or spots, but pale fulvous tomentum forming large patches at sides of second (slightly invading first), third, and fourth segments, and bands along hind margins of these segments (slightly interrupted on second), and covering fifth segment, except that the apex is covered with grey hair; ventral segments with testaceous bands, the fifth with a broad shining ferruginous apical lobe.

Tia Baya, Peru, Aug. 19 (*Wilmatte P. Cockerell*); at flowers of a malvaceous plant (*Malvastrum capitatum*).

A very handsome and distinct species, related to the Argentine *C. prinii*, Holmberg; but much larger, with darker stigma and markings differing in detail.

*Camptopæum (Acamptopæum) vagans*, sp. n.

♂.—Length about 8 mm.

Head and thorax black, the vertex tinged with blue. Abdomen dark blue, green at sides and base; pubescence white, only moderately abundant, forming bands on abdominal segments. Eyes pea-green, face broad; clypeus (except two black spots), labrum, mandibles, supraclypeal mark, large dog-ear marks, lateral face-marks (ending acutely on orbits about halfway up front), and broad stripe on scape yellow; flagellum pale yellowish fulvous beneath; prothorax with an interrupted pale yellow band, tubercles black; mesothorax shining, with extremely fine punctures; tegulæ hyaline with whitish spots. Wings dilute brownish; stigma and nervures dark fuscous; basal nervure falling short of nervulus; second cubital cell a little longer than

first below, receiving first recurrent nervure about twice as far from base as second from apex. All the knees, anterior tibiæ very broadly in front, margins of middle tibiæ on outer side, about half of hind tibiæ, and outer side of basitarsi, all pale yellow; spurs very pale reddish. Abdomen shining, very finely punctured.

Païta, on the coast of Northern Peru, Aug. 28 (*Cockerell*).

Closely related to the Chilean *C. submetallicum*, Spinola, but with differently coloured legs and eyes, and other differences in detail. It is not *C. nigrিতarse*, Vachal, which has the scape all black, and occurs in the mountains of Peru. It is surprising to find a species of Chilean facies so far north.

*Panurginus herbsti*, Friese.

♀.—Chiloe Island, Jan. 1895.

More melanic than the type, the mandibles being black, and the yellow spots on the knees so small as to be almost invisible.

*Pasiphaë peruviana*, sp. n.

♂.—Length about 7·5 mm.

Shining black, without metallic tints, legs and antennæ entirely black, spurs ferruginous; pubescence dull white, long and abundant on head and thorax, dark brown on scutellum. Head very broad; mesothorax and scutellum polished, hardly punctured; tegulæ dark, slightly brownish. Wings hyaline, faintly dusky apically; stigma obscure brown, nervures dark; legs with white hair. Abdomen shining, thinly hairy, without evident bands.

Tingo, Peru, Aug. 22 (*Cockerell*).

Somewhat like the male of *P. rufiventris*, Spinola, which is black, and is, according to Herbst, perhaps identical with *P. tristis*, Spinola. It is readily separated from Spinola's species by the colour of the hair on face and thorax, the whole face and front being covered with long dull white hair.

*Pasiphaë orientalis* (Vachal).

Vachal described this from two specimens, in bad condition, from Argentina. Later, he said he had a specimen from Antofagasta, on the coast of Chile. It is very unlikely that the latter was really the same. I am surprised that any bee should occur at Antofagasta, which is nearly as barren as the moon, except for the cultivated areas in town.

XEROMELISSA, gen. nov. (*Hylæidæ*).

♀.—Mentum very long, so that the mouth-parts can be extruded and look like those of a long-tongued bee, but tongue short, broadly bilobed, strongly fimbriate, with adjacent narrow paraglossa also fimbriate, much as in *Hyleus*; labial palpi three-jointed, first joint very large and broad, longer than the other two combined, with a few scattered spiniform bristles, one on inner side, not far from apex, much longer than the others, being a very little longer than the second joint of palpus; second joint elongated, cylindrical, moderately stout; third slender, longer than second, and having a couple of little spines at apex; blade of maxilla short, divided into an inner opaque portion beset with very numerous long bristles and an outer hyaline part which is about twice as broad in the middle, but no broader at the apex; lacinia neither produced nor hairy; no outer comb; inner comb very well developed, with about a dozen curved bristles; maxillary palpi enormous, extending far beyond blade, three-jointed, dark brown, fusiform, very broad, the basal joint much the shortest, cup-like, with concave apex; second joint longest, extremely broad, about half as wide at apex as at base; apical joint a little shorter than the second, narrow conical, pointed. Finely plumose hairs on head, thorax, and abdomen, but long hair of hind legs (which carries a few pollen-grains) simple; labrum broad, smooth, semi-circular, with a few excessively minute hairs; malar space linear; no facial foveæ, but inner orbital margins marked by a delicate ridge, smooth on the mesad face; antennæ 12-jointed; flagellum short and stout; scape short and thick; antennal joints 4 to 7 much broader than long, 4 and 5 together shorter than 3; clypeus high, facial quadrangle much longer than broad; eyes bare; ocelli large, in a very broad triangle; no pygidial plate; sting-palpi well developed, slender, dark; claws deeply bifid, pulvilli very large; hind spur minutely serrate. Wings minutely hairy; stigma lanceolate, well developed; marginal cell lanceolate, narrowed to obtusely pointed very briefly appendiculate apex, a short distance below costa; two cubital cells, the first much larger than second, but second large, longer than high, very broad on marginal, receiving recurrent nervures very near base and apex; second recurrent ordinary, the apical part vertical (not as in *Colletes*); basal nervure moderately curved, falling short of nervulus by a distance about equal to length of latter; form robust. Head and thorax moderately hairy; postscutellum beset

with minute white plumose hairs; area of metathorax dull, with microscopic raised longitudinal lines. Abdomen broad, without hair-bands, its ventral surface thinly hairy, but with no scopa; hind tibiæ with long hair, not dense; structure of legs ordinary; pale tegumentary markings on head, abdomen, and legs, but none on thorax.

A very remarkable genus, most nearly allied to the Australian *Euryglossa*, but by reason of the extraordinary palpi and other characters forming a new subfamily (Xeromelissinæ). The colour-pattern of the abdomen resembles that of *Neopasiphaë*, from W. Australia.

*Xeromelissa wilmattæ*, sp. n. (Figs. 1 & 2.)

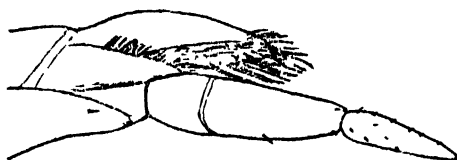
♀.—Length about 6·5 mm.

Black, with white pubescence; eyes light brownish; clypeus with a narrow median yellow band, broadened on

Fig. 1.



Fig. 2.



*Xeromelissa wilmattæ*, sp. n.

Fig. 1.—Tongue and labial palpi.

Fig. 2.—Maxilla and palpus.

upper margin, and joining a broad transverse band which extends along lower margin, the whole making a reversed T; lateral face-marks consisting of short bands between lower corners of clypeus and eye; labrum brown, pallid at extreme base and sides; outer face of mandibles pale yellow; sides of face, upper and posterior part of cheeks, and occiput with conspicuous white hair; lower part of cheeks polished, with small punctures; apical part and under side of flagellum

obscure ferruginous; scape black; clypeus shining; front dull, finely punctured; mesothorax and scutellum shining, finely punctured, nearly bare, but white hair forming a band between them; postscutellum and sides of metathorax with much white hair; tubercles and lateral margins of mesothorax hairy; tegulae pale rufo-testaceous, with a cream-colored spot. Wings dilute brownish, stigma and nervures dark brown. Legs black, with knees, anterior tibiae in front, all tibiae at apex, and basitarsi more or less, yellowish ferruginous. Abdomen dull, convex, without hair-bands or spots, first segment not hairy; hind margins of segments with white tegumentary bands, broadly emarginate anteriorly at sides; venter dark brown without markings.

I am indebted to my colleague, Miss Norma LeVeque, for the figures of the mouth-parts and for critical observations on the tongue and paraglossae. The following measurements are in microns:—long bristle on first joint of labial palpus 53; length of third joint of labial palpi 62; apical joint of maxillary palpi 304.

Tingo, Peru, Aug. 16, 1925 (*Wilmatte P. Cockerell*). At flowers of a malvaceous plant (*Cristaria multifida*).

My wife took one specimen on our first visit to Tingo. We recognized that it was of unusual interest, and she spent much time subsequently trying to get another, but without success. The exact locality is in the railroad cut beyond Tingo station, close to Dr. Hunter's residence..

*Anthophora escomeli*, Brèthes.

Common at Tingo, Peru, Aug. 17–22 (*Cockerell*). It visits malvaceous flowers.

Dr. Edmondo Escomel informed me that he found only two species of *Anthophora* in the vicinity of Arequipa. They were both described as new by Brèthes. The second one, *A. arequipensis*, Brèthes, we also found common at Tingo, visiting the same flowers. Two years later than the publication of *A. escomeli*, Friese described *A. albiceps* from Tarata, Bolivia. It is almost exactly like *escomeli*, but rather smaller, with the hind margins of the abdominal segments yellowish. *A. boliviensis*, Friese, from the same place, is no doubt a variation of *A. albiceps*, as *A. escomeli* varies in a similar manner.

*Anthophora pilifrons*, Packard.

Described from Quito, Ecuador. *A. guachale*, Cameron, also from the mountains of Ecuador, seems to be identical, judging from the description.

*Centris (Trachina) wilmattæ*, sp. n.

♀.—Length 15 mm., anterior wing 9·5.

Head and thorax black, the abdomen bright castaneous red, the hind margins of second and following segments infuscated; legs black, the tarsi red apically, and yellow spot at extreme base of anterior and middle tibiæ; clypeus, labrum, greater part of outer face of mandibles, narrow malar space, and lateral face-marks all very bright yellow; lateral marks broad below, but rapidly narrowing to a slender line along orbits, which grades into a red line along sides of front and over to the posterior orbits, becoming yellow again a short distance above malar space; clypeus high, polished, with scattered punctures; labrum large, triangular, with very pale reddish hair at apex; mandibles quinquedentate, the innermost tooth small; antennæ pure black, the fourth joint brownish; hair of head and thorax above dense, entirely pale fulvous, on front of head, cheeks, and pleura it is white; tegulæ dark brown with pallid margin. Wings faintly dusky, nervures dark. Legs mainly with white or yellowish-white hair, the scopa of hind tibiæ wholly pale, but that of basitarsi dark on inner side; anterior tarsi, and inner side of tibiæ, with red hair; hind knee-plate elongate, rounded apically, where it is red. Abdomen shining, with black hair at apex, venter with broad bands of white hair.

Tingo, Peru, Aug. 22 (*Wilmatte P. Cockerell*).

A distinct species, with the aspect of *C. bimaculata*, Lep., but clypeus wholly yellow, labrum differently shaped, &c. We thought there ought to be a *Centris* at Tingo, but none appeared, until just before we left, on our last visit, my wife caught the present species.

*Thygater arequipensis*, sp. n.

♂.—Length about 12·3 mm.

Black, with the labrum pale yellow; flagellum very long, bright chestnut-red beneath; hair of head long and white, black on vertex; thorax with white hair anteriorly, then a band of black, then orange-fulvous, very bright on scutellum; pleura with white hair; tegulæ dark, with a submarginal fringe of pale hair. Wings with the apical field brownish; basal nervure falling a little short of nervulus; second cubital cell large, quadrate, broader than high, broader above than below, receiving the first recurrent

nervure well before the end. Legs with mainly white hair, red on inner side of tarsi, much black on hind tibiæ and basitarsi. Abdomen shining black, hind margins of segments not pallid, segments 4 to 6 with thin bands of glittering silvery hair, and a thinner band of the same on third; dorsum of abdomen thinly hairy all over; sides of venter with conspicuous white hair.

Tingo, Arequipa Valley, Peru, Aug. 22 (*W. P. Cockerell*).  
At flowers of a plant resembling *Amorpha*.

Extremely close to *T. montezuma*, Cresson, from Mexico; but separated by the banded apical segments of abdomen, broad second cubital cell, and dark tegulæ. There is also some resemblance to *T. bifasciata*, var. *nigricollis*, Vachal, from Argentina.

*Exomalopsis paitensis*, sp. n.

♀.—A small species with the size and form of *E. pulchella*, Cresson, but easily distinguished by the following characters: clypeus shining, with strong punctures; middle of front highly polished; hair of thorax above scanty, not fulvous, pure white on margin of prothorax and tubercles, rusty black on disc of scutellum (as in *E. globosa*, Fabr.); on post-scutellum hair is white, with a pale fulvous tuft in middle; mesothorax more distinctly punctured. Wings brownish, the apex not specially clouded. Stigma deep ferruginous; anterior and middle tarsi with blackish hair on outer side; scopa of hind legs very large, pallid, light grey on outer side, bright ferruginous on inner side of basitarsi. The second abdominal segment has oblique white bands, but no transverse band. The colour of the abdominal hair readily separates it from *E. bruesi*, Ckll., and that of the hind basitarsi from *E. zexmenie*, Ckll.

Paita, Peru, Aug. 28 (*Cockerell*).

*Diadasia chilensis* (Spinola).

Chile. I have both sexes from Dr. Herbst.

Spinola described it under *Anthophora*; Herbst in 1917 placed it in *Ancylloscelis*.

*Diadasia hirsuta* (Friese).

*Ancylloscelis hirsuta*, Friese (Tarata, Bolivia, and Cuzco, Peru).

My wife and I took both sexes in some numbers at Tingo, Peru, Aug. 17 and 18; it visits malvaceous flowers

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(*Malvastrum capitatum*). As Friese remarks, it is very like the North American *D. australis*, Cresson. The females from Tingo are 11.5–12 mm. long; Friese says 9–10 mm.

*Apis mellifera ligustica*, Spinola.

Tingo, Peru, Aug. 17 (*Cockerell*).

The *Malvastrum* and *Cristaria* referred to above were kindly determined by Mr. E. P. Killip.

#### XXIX.—Some *Helicoid* Snails from Manchuria.

By T. D. A. COCKERELL, University of Colorado.

My friend, Mr. A. I. Lavrushin, in the course of a geological expedition, found some snails on the middle fork of the Muren River, in Northern Manchuria. Mr. Lavrushin's work was done under extreme difficulties. He not only suffered from fever, but was twice captured by bandits, who robbed him of his supplies. The region is politically Chinese, but the fauna is that of Eastern Siberia.

#### *Eulota maackii* (Gerstfeldt).

Ordinary in appearance, but size very variable, max. diam. 28 to almost 33 mm. *E. billeana*, Heude, said to come from Sze-chuen, has all the appearance of *E. muackii*. Is it possible that the locality is wrong, or that there is some confusion as to the location of Heude's Kiuntcheou?

#### *Eulota eulemnisca*, Cockerell.

This was described from a shell collected on the coast of the Maritime Province of Siberia. A series of specimens obtained by Mr. Lavrushin in Manchuria must be referred here, though there is no red flush behind the aperture. The texture and colour are as in *E. middendorffi* (Gerst.), but the shell is very distinct, being much less depressed, with a much smaller umbilicus. The surface is much smoother than in *E. maackii*, and there is only a single band, much narrower than the corresponding one of *E. maackii*. The variation in size is considerable, adults having max. diam. 20.6 to 26 mm.

Apparently this shell has been known to authors, and referred to *E. schrenckii* (Midd.). Middendorff's original description states that *E. schrenckii* has max. diam. 15 mm., alt. 10.5 mm., and peristome "vix labiatum." Certainly this is not our shell.

The affinity of *E. eulemnisca* is with the European *E. fruticum*, but it is abundantly distinct. There is a purely superficial resemblance to the Chinese *Mastigeulota kiungsinensis* (Mts.) \*.

*Eulota eulemnisca*, mut. *pura*, nov.

Five shells are creamy-white, entirely lacking the peripheral bands.

*Eulota lavrushini*, sp. n.

Shell with form of *E. ravidata* (Benson), subglobose, thin, semitransparent, shining, dusky pinkish-brown; with rather strong riblets, irregularly spaced, about seven in 5 mm.; spiral lines evident on upper whorls, but apex smooth; sutures rather strongly impressed; peristome thin, columella strongly reflexed over the narrow but well-defined umbilicus; whorls 6. Diam. max. 29, min. 23.5, alt. 28 mm.; length of aperture 20 mm.

One large specimen, perhaps not fully adult, and one about half-grown.

This has undoubtedly been recorded as Benson's *E. ravidata*, but the type-locality of that snail is Chusan Island, and although the general resemblance is very close, I believe our shell is distinct. There is no trace of any colour-band. There are several other, but smaller, species which apparently belong to this alliance. It is quite possible that *E. ravidata*, var. *lineolata*, Mlldff., belongs to the species now described, but it comes from a much more southern locality and is of quite a different colour. It would in any case apparently form a distinct race or variety. The representative of this shell on the Siberian coast is *E. weyrichii* (Schrenck), especially its variety *cinctoinflata* (Mouss.), and I expect that anatomical characters will show more affinity in this direction than in that of *E. ravidata*.

*Eulota murenensis*, sp. n.

Shell compact, elevated, milk-white, with rounded whorls and deep sutures; growth-lines forming coarse striæ, crossed

\* Probably to be called *Mastigeulota unizonalis* (H. Adams), which is very poorly described, but is stated to have been collected by Swinhoe in the Ichang Gorge, which is in Hupe.

by very fine white spiral lines (as in *E. dichroa*, Pfr.) ; apex smooth ; no trace of bands ; aperture rounded, forming about two-thirds of a circle ; peristome white, thin, a little reflected ; columella reflected over the narrow but very distinct umbilicus. Diam. max. 18, min. 12, alt. 11·5 mm. Whorls 6½. Three adults and a juvenile.

This is evidently what has passed as *E. arcasiana*, Crosse and Debeaux (or *E. similis*, var. *arcasiana*) in the Amur fauna. The original *E. arcasiana* came from Shanghai, and had a diameter of 16 mm. ; compared with the present form, the spire is more conical, the last whorl above the aperture much less bulging, and the aperture much less evenly rounded. Our snail seems more like *E. dichroa*, Pfr., also from Shanghai, but can hardly be the same. In spite of the superficial similarity of these forms, it can hardly be believed that the observed differences are merely due to variation, when we consider the extreme difference of climate and latitude between Shanghai and the northern forests of the Amur country.

*Hygromia nordenskiöldi* (Westerlund).

One specimen, max. diam. 12·8 mm., agreeing with Westerlund's description and figures. Westerlund calls it *Eulota*, but Gude transfers it to *Hygromia*, where it surely belongs.

Specimens of the shells described have been sent to the British Museum.

XXX.—“*The New Zealand Glow-worm*,” *Boletophila* (*Arachnocampa*) *luminosa*: Summary of Observations. By G. V. HUDSON, F.E.S., F.N.Z.Inst.

[Plate XL]

I HAVE read with interest Mr. F. W. Edwards's note on this insect, which appeared in the ‘Annals and Magazine of Natural History,’ ser. 9, vol. xiv. p. 175, July 1924, and, whilst I, of course, defer to him in all matters relating to the structure and classification of the Nematocerous Diptera, I feel that his paper quite inadequately presents the observations which were made on this insect (mainly by myself) some thirty-five years ago, and which, so far as I am aware, have not been repeated since that time. The extreme interest of this insect, and its popularity in connection

with a celebrated New Zealand Tourist Resort, the Waitomo Caves, may, I hope, be deemed a sufficient reason for the republication of the following observations, which I desire to bring under notice:—

My first attempt to discover the nature of the New Zealand glow-worm was in January 1885, when I captured several specimens and recorded them as dipterous larvæ, but, through pressure of other work, did not figure or carefully examine them.

Exactly a year later I had the insect again brought under my notice during a conversation with Mr. E. Meyrick, who told me that he had written a short note on the animal. He stated, as his opinion, that the larva was referable to one of Staphylinidæ (Coleoptera), and carnivorous. The light he considered attracted, and the web entangled, minute insects on which he supposed the larva to feed. It will be seen that his supposition as to the nature of the insect is entirely contradicted by subsequent investigation, but the latter conjecture has been fully corroborated by Mr. Norris's observation in 1894, referred to later.

During February and March 1886, I instituted very careful observations on the larvæ, keeping several specimens in captivity. From these I ascertained that the light was not exhibited at all regularly, sometimes being brightest at night and sometimes in the early morning hours. I have since noticed that, in the natural state, the larvæ shine most brilliantly on dark damp nights with a light N.W. wind.

The web referred to above is suspended in a rocky or earthy niche in the banks of a stream or in a cave. It consists of a thick glutinous thread (tube) stretched across the niche, and supported by several smaller threads running right and left, and attached to the sides and end of the cavity. In this tubular thread the larva invariably rests, but, when disturbed, immediately glides back along it, and retreats into a hole in the bank at the end of it. From the lower side of this central thread numerous smaller threads hang down, and are always covered with little globules of mucus, resembling a number of minute silver-beaded necklaces, constituting a conspicuous portion of the insect's web. It should be mentioned that all these threads are constructed by the larva from a sticky mucus exuded from the mouth (?).

The organ which emits the light is situated at the posterior extremity of the larva, and is a gelatinous and semi-transparent structure, capable of a great diversity of

form. It can be withdrawn or extended at the will of the larva, which, however, can immediately cease to shine without withdrawing it. Larvæ cease to shine on very cold nights, in the daytime, and in a room which is artificially lighted.

During my observations in 1886 one of the larvæ disappeared, and I naturally assumed that it had buried itself in the earth, and was undergoing its transformation into the pupa state. This was apparently confirmed by the emergence, in about a month's time, of a fly, which was afterwards identified by Baron Osten-Sacken as *Trimicra pilipes*, the larva of which is well known, and has nothing to do with the present insect. It is most unfortunate that a larva of this *Trimicra* should have got into the breeding-cage without my knowing it, and thus deceived me.

Further investigations were instituted at the end of 1886, when I discovered a luminous pupa suspended in one of the webs, which I have since several times reared from the glow-worm, and is consequently the real pupa. It is a curious animal, and furnished with a large process on the back of the thorax, which is attached to the web, and holds the pupa suspended in the middle of the niche previously inhabited by the larva. The light is emitted from the posterior segment of the pupa, but is much fainter than in the larva, and a distinct organ is not apparent. It is frequently suppressed for days together. This pupa died in a few days, and all the larvæ then under observation also died.

Larvæ were again procured in August 1888, but this time I did not succeed in getting any of them as far as the pupa stage. I should mention that the larvæ are only to be obtained by walking up the bed of the stream, in the big ravine of the Botanical Gardens, at night, with a bull's-eye lantern. A piece of thin stick is rapidly introduced behind the larva, as soon as it is detected, which always adheres to it, and is thus taken away, web and all, and carried home in a tin box, with damp moss, &c.

On September 1st, 1888, I obtained another supply of larvæ, placing them this time in a large bell-glass, with stones and ferns, the bottom of the glass having about one inch of water in it: this I conceived would closely resemble their natural habitat. During all my expeditions I always examined a great number of the webs, and could never find any remains of insects entangled. I also noticed that the largest larvæ were always concealed in the deepest niches in the bank, and frequently behind large cobwebs, where

they would stand a poor chance of capturing insects. I also think that there must be a very great mortality among the larvæ, judging from the number of minute ones always observed, in natural conditions, compared with large ones. On December 21st, I found that two of the larvæ had changed into pupæ resembling the one I found two years before. These unfortunately became mouldy, and died; and it was not until the following April that I succeeded in rearing the true fly, which I discovered, on the morning of the 4th, standing beside its old pupa-skin. Two enlarged drawings were then made, and forwarded to Mr. Skuse, of Sydney, and Baron Osten-Sacken, of Heidelberg, Germany. Both these gentlemen had been previously furnished with specimens of the larvæ in alcohol. They then expressed their opinion that the fly, of which I sent a drawing, did *not* result from the luminous larva, and that it would be desirable to postpone publication until another specimen had been reared. Convinced though I was of the accuracy of the observation of April 4th, I determined to verify it, and again procured larvæ, which all died. On July 10th, 1890, I got about twenty large larvæ, spending upwards of three hours in the bed of the stream: two of these changed during August into pupæ, one of which died, but the other gave rise to another fly exactly resembling the one reared on April 4th, 1889. The circumstances connected with the emergence of this fly are so entirely conclusive that it may perhaps be well to relate them in detail. On examining the pupa at 8 A.M. on the 14th, I observed that it had become much paler in colour. At 2 P.M. I noticed the fly perched on it, with its head down towards the tail of the pupa, *and the extremity of the abdomen of the fly still within the pupa-skin.* In this position it remained until the following day at 5 P.M., when I transferred the fly into a large glass-topped pill-box, which I placed on the table in my sitting-room. On returning to the room at 7 P.M. without a lamp, I was astonished to see the inside of the box brilliantly lit up, the extremity of the fly's abdomen giving out a strong light, about half as bright as that emitted by a full-grown larva. The whole phenomena relating to the emergence of this fly from the pupa, and its subsequent luminosity, were also observed by my brother, who was present at the time, and can fully corroborate these statements if necessary. As this was a female fly I decided to take her into the big gully in the gardens, where the larvæ are abundant, and see if she would attract males. As soon as I arrived I put the box down in the bed of the stream, and the fly immediately

lit up so as to again strongly illuminate the inside of the box. There were lots of larvæ all round, so that I considered it likely there were also flies. After thirty-five minutes I visited the box, but found nothing had arrived. I then left her for ten minutes more, and returned with the same result. During this expedition I again carefully examined many webs of the larvæ, and took a quantity of the mucus from them home, and examined it with the microscope. I could, however, find no trace of insects entangled or their remains. I am quite at a loss to explain either the light or the web, also the food of the larva. I must leave these points for future investigation.

I should mention that the flies reared on April 4th, 1889, and September 14th, 1890, were both females, as it is conceivable that this may have an important bearing on future inquiry as to the use of the light.

The scientific description of this fly by Mr. Skuse, who named it *Boletophila luminosa*, is printed in the 'Transactions of the New Zealand Institute,' vol. xxiii. p. 47. The type-specimen was deposited in the Australian Museum, Sydney. The other specimen reared I retained in my own collection. In 1924 I lent this specimen to Mr. Edwards for comparison with the male fly captured by Mr. Edwards, senr., in the Waitomo Cave. It will be seen from the foregoing that there is no need for any "*assumption*" that *B. luminosa* was reared from the New Zealand luminous larva, *but there is indisputable proof of the fact*. I will deal with Mr. Edwards's conjecture as to the existence of two species of "*glow-worm*" in New Zealand later.

Now as to the food of the larva. Mr. A. Norris, who unhappily for science died in early life, resided close to the ravine in the Wellington Botanical Gardens, where the larvæ were then common, this being the identical spot where they were observed by myself. He was my pupil, and continued observing them after I left the locality—that is, during the years 1892 and 1893,—and the following note, sent to the 'Entomologists' Monthly Magazine' at my instigation, appeared in September 1894, p. 202. This note summarizes the results of his observations and mainly agrees with mine, except that Mr. Norris considered that the mucus was secreted from the skin of the larva, and this is very possibly correct. He was also fortunate enough to prove that the larva was carnivorous. His paper is as follows:—

"I have observed the larvæ in their natural haunts

forming their webs, which consist of a kind of mucus, which is discharged from all parts of the body. If you take a larva from its web and put it on the ground, it will stay there until it has discharged enough of this mucus from which to slide out. Wherever it goes it leaves a mark in the same way as the snail. When the larva is making a fresh web, it raises its head and first four or five segments in the air, and reaches round about until it strikes something. It then draws its head back a little way, thus making a very fine thread of mucus. It then passes it to the thick mucus on the first segment, then slides out a little way, and makes another thread on the other side in the same way, fastening each to the thick mucus on the body. When it has made a sufficient number of these braces, it begins to make the strings of beads which hang downwards from these braces by gliding out on the braces, and lowering its head and about half the body. It then works its head and body up and down as if to vomit. You can see the mucus gathering on the body. Then it draws its head right back into the first two segments, as if it were turning inside out. It then catches hold of the mucus on the edge of the segment, and forces it forward. Now the head is out straight, with a large drop of mucus all round it like a drop of water. Then it draws its head gently out of the mucus, thus making a short fine thread from it. It then makes another drop, and another short thread; then a drop, and so on, until it has made several of these pendants of beads, which may vary in length. I have seen them from one inch to four or five inches. I believe in caves, where there is no wind, they reach the length of two feet. At night, when the larva is shining, you can see the reflection of the light for a considerable distance along the main thread or *tube*. When it is in a small cave, the light also reflects on the pendants of beads, thus lighting up the whole of the cave. I call it the main *tube*, because the larva does not rest on the thread, but glides through it, which can easily be seen when the larva is in the centre of the thread, or tube, and tries to get out through the side. You can see it pushing, and moving its head about as if to break the side of the tube before it gets out.

"It is my belief that the web is formed to entangle insects, which are attracted by the light.

"The following are my reasons. I have frequently found small Diptera, Coleoptera, Lepidoptera, and a great many of the Crustacea entangled in the sticky web of the larva (which is very strong). I have also noticed that several of



the Coleoptera, when taken out of the webs, were hollow, showing that the interior had been extracted in some way. When the insects are alive, the larva may be seen smothering them with mucus. On the 17th February, 1894, I saw that one of the larvæ had a crustacean in the web. The larva's head was thrust inside the shell of the crustacean. I at once used the lens, and could plainly see the mandibles working, and that the larva was eating the animal. I blew the web gently, when the larva at once stopped eating, but proceeded again. Again I blew, but harder, when it at once retreated, taking the animal part of the way with it. There are frequently fragments of insects to be seen stuck on the rocks at the sides of the webs, as if, when a larva had finished an insect, he turned it out of the web, and was ready for more.

"The ♂ and ♀ can easily be distinguished in the pupa. In the first place, the male is much smaller and not so stout as the ♀, and the end of the ♂ abdomen is very abrupt. On the other hand, the ♀ is much stouter, and the end of the abdomen comes to a point and has two small fans. Both larvæ and pupæ are luminous, the ♀ being so in all three stages. The ♂ is luminous in the pupa until the last two or three days before it hatches. I have three males, and none of them was luminous in the imago."

"Wellington, N.Z., May 1894."

I may add here that Mr. Norris also discovered that a hymenopterous insect, with an apterous female, *Betyla fulva*, Cameron, is parasitic on the N.Z. Glow-worm (see Trans. N.Z. Inst. vol. xxv. p. 164 (1892), and 'Entomologists' Monthly Magazine, November 1892).

My quotation of Mr. Norris's observations in full and the circumstances under which they were made will, I hope, show that there is absolutely no foundation for Mr. Edwards's conjecture that we were observing two different species of luminous larvæ. Dr. Guy A. K. Marshall's suggestion, made to me in 1923, that the larva drops the remains of its victim after eating it is entirely in accord with Mr. Norris's observations, and probably explains my failure to find evidences of captured insects in the webs, though in this respect Mr. Norris was certainly much more successful than myself. Dr. Marshall's explanation of the use of the pendant "necklaces" as "fishing lines" is also clearly correct, and marks an important step in our knowledge of the insect's economy.

Let me here point out that Mr. Edwards's own paper proves that the *same* species of glow-worm is found at Wellington and at Waitomo, as, on comparing my specimen reared from the larva in Wellington with the fly captured by his father in the Waitomo Cave, he found them identical.

As regards the *Ceroplatus* larvæ, sent by Mr. T. R. Harris of Ohakune, I desire, first, to state that Ohakune is situated between Wellington and Waitomo; and, secondly, to inquire whether, in view of all the facts I have now given, it is not more probable that Mr. Harris has "confused" the issue than myself? So far as I know, Mr. Harris has never reared the New Zealand glow-worm, and presumably has no very intimate knowledge of that insect, never having communicated any note on the subject. I am aware of at least one other Dipterous larva, living in a slimy web in cavities, under logs, but nothing to do with the N.Z. glow-worm, and it seems to me, at least, possible that some specimens of this larva may have been sent to Mr. Edwards by Mr. Harris\*. Of course, it is quite possible that a second species of luminous larva may exist in New Zealand, but at present there is no warrant for assuming its existence.

Finally, Mr. Edwards raises the general, and most important, question as to whether larval characters should be used for purposes of classification? To this question I should say, in nearly every case, No. It is a commonplace of entomology that insect-larvæ are subject to extreme modification to meet the requirements of the struggle for existence—instance those cases ranked as hypermetamorphosis. It follows, therefore, that larval structures, generally, have been subject to the most profound adaptations, through the agency of natural selection. Darwin condemns the use of larval characters for purposes of classification ('Origin of Species,' 6th ed. p. 345), and in the same chapter explains that "the less any part of the organization is concerned with special habits, the more important it becomes for classification." We have a striking example of the misleading nature of larval resemblance in the larvæ of the sawflies and the caterpillars of the Lepidoptera.

#### EXPLANATION OF PLATE XI.

*Boletophila (Arachnocampa) luminosa.* Larva, pupa, and perfect insect.

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\* Mr. Edwards has since admitted to me that the larva sent to him by Mr. Harris was not a "glow-worm," but the *Ceroplatus* larva living in slimy webs under logs.

XXXI.—*A new Tachinid (Dipt.) from Australia, with Notes on the Forms with obliterated Fourth Vein.* By Prof. M. BEZZI, Turin, Italy.

In the genus *Actia*, accepted in its widest sense, there is a group of species characterized by having the fourth longitudinal vein of the wings quite absent in its last portion. This aberrant character was considered to be of generic value by Robineau-Desvoidy, who, in 1830, established thereupon the genera *Actia*, *Roeselia*, and *Melia*. But subsequent writers, beginning with Macquart in 1833\*, have ascribed to it in some cases only specific value, inasmuch as sometimes the interrupted vein may be visible beyond the bend in the shape of a spurious continuation. Bigot, however, in 1882†, proposed the artificial group Actiadæ, accepted by Karsch‡; and Brauer and Bergensstamm in 1893§ offered a partial synopsis of these heterogeneous elements.

The number of the genera of Tachinidæ in which the fourth vein may be more or less obliterated at the apex is considerable, and the following key is proposed here for their distinction:—

- 1 (24). Fourth vein quite cut off before the end, being completely invisible beyond the bend.
- 2 (7). Hind cross-vein quite absent.
- 3 (6). Basal joints of arista elongate; third antennal joint considerably longer than the second.
- 4 (5). First vein quite bare at end ..... *Phytomyptera*, Rond.
- 5 (4). First vein with a strong bristle before the end. .... [Johns., 1907.  
*Dichæoneura*,
- 6 (3). Basal joints of arista not elongate; third antennal joint not longer than the second and nearly circular ..... *Thrixion*, B.-B.
- 7 (2). Hind cross-vein present.
- 8 (13). Third vein bristly to the small cross-vein or even beyond it; first and fifth veins sometimes also bristly; basal joints of arista elongate.

\* 'Insectes Diptères du Nord de la France,' Lille, 1834, p. 313; and 'Suites à Buffon,' Paris, ii. 1835, p. 92.

† Ann. Soc. ent. France, (6) ii. 1882, p. 9.

‡ "Beitrag zur Kenntniss der Dipterengruppe Actiadæ, Bigot," Berl. ent. Zeitschr., xxx. 1886, pp. 135-137.

§ Denkschr. math.-naturw. Classe Kais. Akad. Wiss., Wien, lx. 1893, p. 92.

- 9 (12). Proboscis not elongate.
- 10 (11). Frons distinctly prominent, and thus the face retreating; first and third veins bristly ..... [1886.  
*Reichardia*, Karsch,
- 11 (10). Frons not prominent and face not retreating; third vein bristly, and often even the first and the fifth likewise bristly ..... *Actia*, R.-D.
- 12 (9). Last portion of the proboscis distinctly elongate; first, third, and fifth veins bristly ..... [1917.  
*Actiopsis*, Towns.,
- 13 (8). Third vein bare, or only with 1-4 bristles at extreme base; all the other veins bare; basal joints of arista not elongate.
- 14 (23). Abdomen with distinct segmentation; genitalia not folded below the venter; mouth-border not prominent.
- 15 (20). Antennæ short, considerably shorter than the face.
- 16 (19). Third antennal joint rounded at end; parafacialia bristly or hairy below; frons of male broad, claws of same sex short and small.
- 17 (18). Wings without costal bristle; præsutural acrostichal bristles well developed; arista bare ..... *Melizoneura*, Rond.
- 18 (17). Wings with strong costal bristle; præsutural acrostichal not distinct; arista pubescent ..... [Strobl, 1899.  
*Melanomelia*,
- 19 (16). Third antennal joint with a prominent point at lower front corner; parafacialia quite bare; frons of male narrow and claws elongate ..... *Hemithrixion*, B.-B.\*.
- 20 (15). Antennæ long, about reaching epistome.
- 21 (22). Hind cross-vein midway between small cross-vein and bend; facial ridges bristly to the middle ..... *Rhaodineura*, Rond.
- 22 (21). Hind cross-vein very approximate to the small one; palpi dilated at end ..... [Stein, 1924.  
*Phytomyzoneura*,
- 23 (14). Abdomen with partly fused segments; female genitalia folded below the venter; mouth-border rather prominent ..... *Apostrophus*, Loew.
- 24 (1). Fourth vein more or less visible to the end, but spurious or interrupted beyond the bend.
- 25 (28). Third vein bristly to the small cross-vein, or even beyond it; hind cross-vein nearer to the small one than to the bend; basal joints of arista elongate.
- 26 (27). Terminal portion of proboscis short .... *Actia*, R.-D.

\* For description and figures, see W. R. Walton, Proc. Ent. Soc. Washington, xvii, 1915, p. 105, pl. xiii., *Coquilletina plunkii*, which is synonymous according to Aldrich, Ann. Ent. Soc. America, xvii, 1924, p. 217.

- 27 (26). Terminal portion of proboscis distinctly elongate ..... *Actiopsis*, Towns.  
 28 (25). Third vein with 2-3 bristles only at extreme base; hind cross-vein in middle; basal joints of arista very short.  
 29 (32). First posterior cell open; antennæ long.  
 30 (31). Frons of male with orbital bristles .... *Rhacodineura*, Rond.  
 31 (30). No orbitals in the male ..... *Pexomyia*, B.-B.  
 32 (29). First posterior cell closed and stalked; antennæ short ..... *Apostrophus*, Loew.

In all the above-named genera the fourth vein, when continued beyond the bend, is curved toward the fore margin of the wing to form the usual apical cross-vein. In some other genera of Tachinidæ the fourth vein is only a little curved above, as, for example, in *Gymnopezæ*, Zett., *Apinops*, Coq., &c.; or it is almost straight, as in *Cinochira*, Zett.; or even perfectly straight, as in *Eginia*, R.-D. (*Syllegoptera*, Rond.), *Syngomoptera*, Schuabl (1902), *Xenotachina*, Malloch, 1921; but in all these genera the fourth vein is always continued to the wing-border.

In the genus *Actia* two species only were formerly described by Robineau-Desvoidy\*; one with bare wing-veins (*cingulata*, R.-D.), and one with ciliated veins (*pilipennis*, R.-D.). Subsequently the same author† restricted the genus *Actia* to the latter form, creating the genus *Elfia* for the former. Coquillett was therefore in error in indicating‡ as genotype of *Actia* the species *cingulata*, inasmuch as Rondani had already§ selected *pilipennis* (under the name of *vitripennis*) as type for the same genus. *Elfia cingulata*, R.-D., is at present unrecognized; but cannot be placed as a synonym of *Actia lamia*, Meig.

In Europe *Actia lamia*, Meig. (*pilipennis*, R.-D.; *frontalis*, Macq.; *obscura*, R.-D.; *vitripennis*, Rond.), with three wing-veins bristly, is not rare; in North America its place seems to be taken by *Actiopsis autumnalis*, Towns., which is distinguished only by the elongate proboscis. But there are also species with only one vein bristly, like *curvicornis*, Meig. I have never seen this last species, but I have received for determination from the Imperial Bureau

\* 'Essai sur les Myodaires,' Paris, 1830, p. 86.

† "Myodaires des environs de Paris," Ann. Soc. ent. France, (2) viii. 1865, p. 190; and 'Histoire Naturelle des Diptères des environs de Paris,' i. 1863, p. 672.

‡ "The Type-species of the North-American Genera of Diptera," Proc. U.S. Nat. Museum, xxxvii. 1910, p. 503.

§ 'Dipterologia italicæ Prodromus,' Parma, i. 1856, p. 60; and iii. 1859, p. 18.

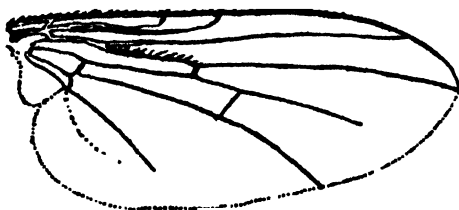
of Entomology a species from Australia, apparently belonging to the same group.

The known species of *Actia*, with obliterated fourth vein, are as follows :—

- |   |                            |
|---|----------------------------|
| 1 (4). Only the third vein bristly.   |                            |
| 2 (3). Third antennal joint with curved external border; calypters yellowish; abdominal whitish bands interrupted . . . . . | <i>curvicornis</i> , Meig. |
| 3 (2). Third antennal joint parallel-sided; calypters whitish; whitish abdominal bands not interrupted . . . . .            | <i>eucosmæ</i> , sp. n.    |
| 4 (1). First, third, and fifth veins bristly.   |                            |
| 5 (6). Last portion of proboscis short, as usual . .  | <i>lamia</i> , Meig.       |
| 6 (5). Last portion of proboscis noticeably elongate . . . . .  | <i>autumnalis</i> , Towns. |

*Actia eucosmæ*, sp. n., ♀.

Easily recognizable by the fourth vein being interrupted at the bend by only the third vein being bristly; and by the close approximation of the hind cross-vein to the small one.



Wing of *Actia eucosmæ*, sp. n.  $\times 24$ .

Type ♀, a solitary specimen from Brisbane, Queensland, Australia, bred from *Crocidosema (Eucosma) plebiana*, Zell. (*E. Ballard*).

♀. Length of body about 3 mm.; of wing 2.5 mm. Occiput black, densely clothed with opaque grey dust, but with whitish ocular border; postocular cilia black, disposed in one row, with a second irregular row of minor ones superiorly. Frons distinctly broader than one eye, only a little widening forwardly; parafrontalia densely clothed with whitish dust; ocellar triangle large, grey; middle stripe reddish, narrow, about half as broad as one of the parafrontalia; outer vertical bristles well developed, but noticeably smaller than the inner ones; ocellars well developed, diverging; frontals 5-6, the two upper ones

curved behind, the anterior ones reaching the base of second antennal joint; two orbitals, curved forwards; all bristles black. Eyes bare, ovate, their vertical diameter twice as long as the horizontal one. Antennæ considerably above the middle of eyes, entirely reddish; third joint parallel-sided, rounded at end, but with rather prominent upper corner, three times as long as the second, and about reaching the epistome; arista blackish, about as long as the third antennal joint, with the first joint short and the second elongate, as long as one-fourth of the third, which is thickened to about the end. Parafacialia much narrower than the third antennal joint, only a little widened below, quite bare, whitish; face concave, not carinate, whitish; mouth-border not prominent, vibrissæ long and decussate, with only 1-2 hairs above and 2-3 below; peristomialia about as broad as the breadth of third antennal joint, whitish, with a reddish stripe, bare, with scattered black bristly hairs behind. Palpi reddish, clavate, bare; proboscis black, with reddish flaps, the terminal portion not much longer than the palpi. Thorax black, but entirely clothed with opaque, light grey dust; back subquadrate, only a little longer than broad, not dark-striped; pleuræ unspotted; hairs and bristles black, inserted on small black dots; *dc.* 2+4, but only the last two pairs strong, the others being short and thin; no well-differentiated præ-sutural acrostichals, only the præscutellar pair being strong, the acrostichal hairs being disposed in six rows; three post-sutural intra-alars; sternopleurals 1:1; pteropleura bare; 4-5 hypopleurals. Scutellum about as long as one-half the back, and similarly grey-dusted, with only the extreme tip a little reddish, evenly clothed with short bristly hairs, with three pairs of long marginal bristles, with no distinct discs, the apicals very small and decussate. Calypters whitish with white border, the lower one twice as long as the upper, and bare on disc; halteres reddish. Abdomen broad, flat, rounded; it is black and rather shining, the 2nd, 3rd, and 4th segments with a very narrow, uninterrupted, whitish band at base, the 4th almost entirely grey-dusted; bristles short and only marginal, but one pair in middle of 2nd segment, and a complete row on 3rd and 4th, venter black, with narrow whitish bands; no visible ovipositor. Coxæ and trochanters reddish; femora black, with narrowly reddish base; tibiæ and tarsi entirely black; pulvilli and claws exceedingly minute. Wings (see text-fig.) hyaline, without costal bristle; veins blackish, narrowly yellowish at base. First vein quite bare; second straight; third

with 7-8 bristles, extending from base to the small cross-vein; fourth quite straight, interrupted before the bend, with no visible spurious continuation; hind cross-vein very near to the small one, straight, only a little shorter than its distance from the small one; fifth vein quite bare; sixth vein ending at some distance before the hind border of wing.

XXXII.—*On Freshwater Prawns of the Family Atyidæ from Queensland.* By W. T. CALMAN, D.Sc., F.R.S.

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THE specimens described in this paper were collected by Capt. G. H. Wilkins in the course of his expedition to Australia (1923-25) on behalf of the British Museum (Natural History).

Bouvier's recently published Monograph\* gives an admirable account of the morphology, relationships, and distribution of the members of the family.

*Paratya australiensis*, Kemp, var.

*Paratya australiensis*, Kemp, Rec. Indian Mus. xiii. pt. 5, p. 303, fig. 5 (1917); Bouvier, Recherches, p. 62, fig. 86 bis.

**Occurrence.** St. George District, Queensland. In bore water drain. 2 ♂.

**Remarks.** In both specimens the propodus of the third peræopods is about three times, that of the fifth distinctly less than three times, as long as the dactylus (including the terminal spine); in neither case is the propodus dilated; the dactyli are much more than three times as long as broad. The carpus of the first peræopods is about two and a half times as long as broad, that of the second pair about seven times. There are nine spines on the third dactylus, ten on the fourth, and about fifty-two on the fifth. The rostrum extends only to the middle of the second antennular segment or a little less, and has  $\frac{16}{1}$  and  $\frac{18}{2}$  teeth in the two specimens. All the dorsal teeth are in front of the orbital notch.

It will be seen that the specimens differ considerably from the typical form of *P. australiensis*, especially in the characters of the rostrum; and it is quite possible that they represent a distinct local race of the species. Ortmann

\* E. L. Bouvier, "Recherches sur la morphologie, les variations, la distribution géographique des Crevettes de la famille des Atyidés," Encyclopédie Entomologique, iv. Paris (Lechevalier), 1925. 8vo, pp. 370, 716 text-figs.



records a member of the genus from Queensland, but gives few details as to its characters.

CARIDINIDES, gen. nov.

Resembling *Caridina*, but having a well-developed exopod on the first pair of chelipeds.

No supraorbital spine. Chelipeds of the *Caridina*-type, carpus of first pair slightly excavated. An arthrobranch at the base of first chelipeds (nine pairs of gills). A number of spines on exopod of uropods.

Genotype. *Caridinides wilkinsi*, sp. n.

*Caridinides wilkinsi*, sp. n. (Figs. 1 & 2.)

*Occurrence.* Olive River, Temple Bay, east coast of Cape York Peninsula. Many specimens were taken by Captain Wilkins at a point quite close to the sea, where the water was brackish. The river is separated from the sea by a sand-bar, which is covered at spring-tides.

*Description.* Rostrum equal to, or a little longer than, antennular peduncle, slightly sinuous, spines  $\frac{1-3+17}{3-8}^{22}$ , the dorsal spines continued, as a rule, to the tip. Postorbital length of carapace exceeding by one-third the dorsal length of sixth abdominal somite. Infraorbital angle prominent and distinct from antero-lateral spine. Pterygostomial angle narrowly rounded.

Antennular carina inconspicuous. Antennular peduncle about  $\frac{2}{3}$  of length of carapace; second segment more than two-thirds as long as first, and nearly twice as long as third; stylocerite extending to three-fourths of first segment, distal spine to one-third of second segment. Antennal peduncle reaching to end of first antennular segment. Tip of antennal scale projecting beyond external spine, which extends a little beyond the antennular peduncle.

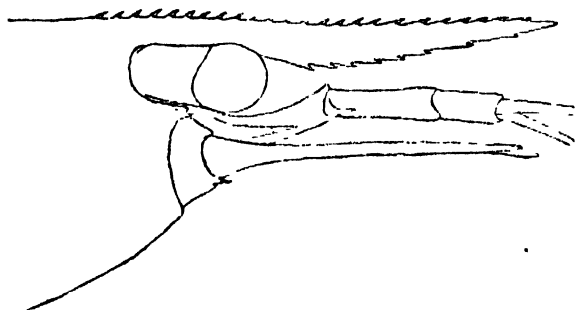
Distal lacinia of maxillula hardly produced beyond the spinose inner margin. Distal lobe of maxilla little more than half as long as the adjacent lobe; the hook at the base of the exopodal setæ serrated. Distal segment of third maxilliped more than two-thirds as long as the preceding, with about fifteen distal spinules.

First chelipeds with exopod extending to middle of merus, with a few long plumose setæ at tip; carpus slightly but distinctly excavated, nearly three times as long as wide and a little over four-fifths of length of chela; fingers a little longer than palm, with a terminal claw, broadly spatulate, incurved and truncate, flanked by three or more series of serrated spines.

Second chelipeds without exopod; carpus six times as long as wide, and one-third longer than chela; fingers longer than palm.

Third and fourth peræopods with with one spine on ischium, three or four on merus, and one large and two or

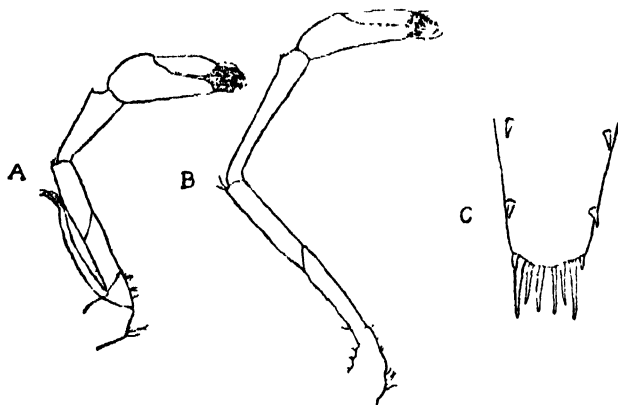
Fig. 1.



*Caridinides wilkinsi*, sp. n.

Anterior part of carapace &c., lateral view.

Fig. 2.



*Caridinides wilkinsi*, sp. n.

A. First cheliped. B. Second cheliped. C. Tip of telson.

three small ones on carpus; dactylus less than one-fourth of length of propodus, with seven to nine spines. Fifth peræopods with no spine on ischium and only one on merus; dactylus about one-third of length of propodus, with 34-50 spines.

Epipods absent from last three pairs of legs.

Uropods with eight or nine spines on exopod. Telson with four pairs of dorsal spinules (including subterminal pair) and three pairs of terminal spiniform setæ, of which the intermediate pair are the shortest.

Total length of largest specimens about 20 mm. No ovigerous specimens were found.

*Remarks.* The only Atyidæ hitherto known which have exopods on any of the peræopods are the genus *Xiphocaris* and the group of genera forming Bouvier's "Série paratyienne." The former is distinguished by a number of other characters, which justify us in regarding it as a very primitive member of the family. The Paratyan series of genera have also certain features in common—such as the supraorbital spines, the absence of arthrobranchs from the legs, and the presence of only one or two exopodal spines on the uropods—which mark them off as a natural group, and as, on the whole, more primitive than the remaining genera, although more specialized than *Xiphocaris*.

The new species now described does not disturb the basis of Bouvier's classification, since it shows no approach in other characters to the Paratyan series. Except for the presence of an exopod on the first cheliped, it is a normal *Caridina* belonging to the group of *C. nilotica*, and approximating, in Bouvier's key, to *C. propinqua*, de Man, and its neighbours. It has been given a new generic name merely as a measure of practical convenience, and not as indicating a belief that it is phylogenetically more primitive than any of the numerous species of *Caridina*. It may be so; but, as Kemp has pointed out (Rec. Indian Mus. xix. p. 138, 1920), it is unsafe to regard the presence of exopods on the peræopods as necessarily a primitive character among the Caridea, since they are frequently retained in the larvæ. The occasional persistence of a larval character in the adult stage of unrelated genera would not infringe the law of the "irreversibility of evolution."

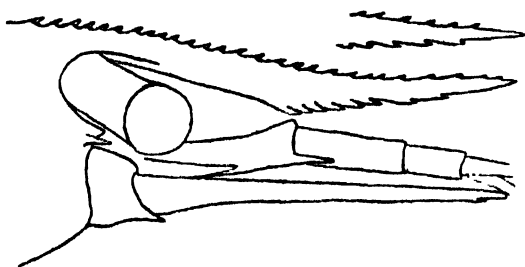
*Caridina indistincta*, sp. n. (Fig. 3.)

*Occurrence.* St. George District, Queensland. In bore water drain. Eight specimens.

*Description.* Rostrum extending slightly beyond the antennular peduncle, gently curved downwards at the base and upwards at the tip, slender, its depth not more than one-ninth of its length; 20 to 32 spinules above, of which

1 to 3 are behind the orbit, the distal ones extending almost or quite to the tip, and 4 to 8 teeth below. Stylocerite reaching about the middle of the first antennular segment, distal spine not reaching middle of second, which is not quite two-thirds of the first; third segment more than half as long as second. Antennal scale about equal to rostrum; angle of second segment spiniform. Carpus of first chelipeds about three times as long as wide, and shorter than the chela, which has the fingers longer than the palm. Carpus of second chelipeds about six times as long as wide, longer by one-quarter than the chela, which has the fingers longer than the palm. Dactylus of third and fourth peræopods less than one-third of propodus, with seven and eight evenly graduated spines respectively; that of fifth peræopod one-third of propodus, with thirty-three spines.

Fig. 3.

*Caridina indistincta*, sp. n.

Anterior part of carapace &c., lateral view.

Merus of third and fourth pairs with two spines, that of fifth with one. Epipods on peræopods 1 to 4. Telson with six pairs of dorsal spinules (including subterminal pair), and with seven or eight terminal plumose spines (in about half of the specimens the number is odd), of which the outer pair are longer and stronger than the others. Exopod of uropods with nine spines.

The following proportions are expressed according to the scheme adopted by Bouvier (p. 47):—

$$\frac{pa'}{o} = .93, \quad \frac{pr \cdot p^3}{o} = .5, \quad \frac{6a}{o} = .72, \quad \frac{d}{pr} p^3 = .28, \quad \frac{d}{pr} p^5 = .33.$$

Total length (♀) 17 mm.

*Remarks.* The length of the antennular peduncle and of the sixth abdominal somite, the form of the rostrum, and the number of the uropodal spines show that this species belongs to the group of *C. nilotica* as defined by Bouvier

It is not impossible that it may even deserve to be included within the wide limits assigned to the polymorphic type-species of the group, which has already been recorded from Queensland under the name of *C. vycki* by Ortmann\*. It differs from all the subspecies of *C. nilotica*, except one, in having the dorsal serrations of the rostrum continued, without any interruption, to the tip. Kemp and Bouvier have described a similar armature of the rostrum in some forms of *C. brachydactyla*, which Bouvier ranks as one of the subspecies of *C. nilotica*; but in other respects (the short dactyli of the walking-legs, and the enlarged subapical spine of the third and fourth pairs) *C. brachydactyla* differs greatly from the Australian form. Of the other species of this group, Bouvier's key brings it into closest relationship with *C. de mani*, Roux, and *C. rajadhari*, Bouvier, from both of which it differs widely in nearly all the proportional measurements given above.

XXXIII.—On the Synonymy of the Genera *Isoparorchis*, Southwell, 1913, and *Leptolecithum*, Kobayashi, 1920, with a Description of the Male Genitalia of *Isoparorchis trisimilitubis*, Southwell, 1913. By G. D. BHALERAU, M.Sc. (Biological Department, University of Rangoon).

In 1921 Dr. Woodland obtained from the gas-bladder of *Wallago attu* from the Ganges, Allahabad, about twenty-one flukes, three of which he handed over to me; these, on examination, proved to be *Isoparorchis trisimilitubis*, Southwell, 1913. I am indebted to Dr. B. Prashad, of the Indian Museum, Calcutta, who kindly spared for me half a dozen specimens of these worms out of the collection of the Indian Museum, and also to Mr. Ram Saran Das, of Allahabad University, who sent me his mounted slide of this worm at my request.

In 1920 Kobayashi described as *Leptolecithum eurytremum* a Trematode which he obtained from the gas-bladder of *Parasilurus asotus* and *Pseudobagrus aurantiacus* in Japan. Before making any further remarks in this connection, a comparison between the descriptions of *Isoparorchis trisimilitubis* and *Leptolecithum eurytremum* will be instructive.

\* Bouvier's statement ('Recherches,' p. 260) that the genus *Caridina* may, perhaps, be absent from Australia is probably an oversight, and not intended to throw doubt on Ortmann's record.

*Table of Comparison between Isoparorchis trisinilitubis, Southwell, 1913, and Leptolecithum eurytremum, Kobayashi, 1920.*

	<i>Isoparorchis trisinilitubis.</i>	<i>Leptolecithum eurytremum.</i>
Shape . . . . .	Leaf-like, transparent, longer than broad, broadest at $\frac{1}{2}$ of body.	Flat, broadest at $\frac{2}{3}$ the distance from anterior end.
Size . . . . .	10-35 $\times$ 4.5-18 mm.	13 $\times$ 7 mm.
Suckers . . . .	Ventral sucker near anterior extremity.	Ventral sucker at $\frac{1}{2}$ the length of body.
Intestine . . . .	Winding, caeca reach posterior end.	Winding, caeca reach posterior end. "Drusenmagen" present.
Excretory system.	Excretory bladder varying, branches winding.	Excretory bladder bifurcates at $\frac{1}{2}$ the length of body, branches winding.
Testes . . . . .	Symmetrical, immediately posterior to ventral sucker.	Placed laterally, immediately posterior to ventral sucker.
Vesicula seminalis.	Winding anterior to ventral sucker.	Winding anterior to ventral sucker.
Ovary . . . . .	Tubular, posterior, to the right.	Tubular, posterior, to the left.
Genital pore . .	Midway between two suckers.	Midway between two suckers.
Uterus . . . . .	Winding with intestinal caeca.	Winding with intestinal caeca.
Laurer's canal.	Not observed.	Present.
Receptaculum seminis.	Not observed.	Present.
Vitellaria . . . .	Dendritic.	Dendritic.
Shell-gland . .	Small.	Small.
Eggs . . . . .	0.037-0.039 $\times$ 0.020-0.023 mm. Operculated.	0.048-0.05 $\times$ 0.023-0.025 mm. Operculated.
Host . . . . .	Siluroid fish.	Siluroid fish.
Habitat . . . .	Gall-bladder.	Gall-bladder.

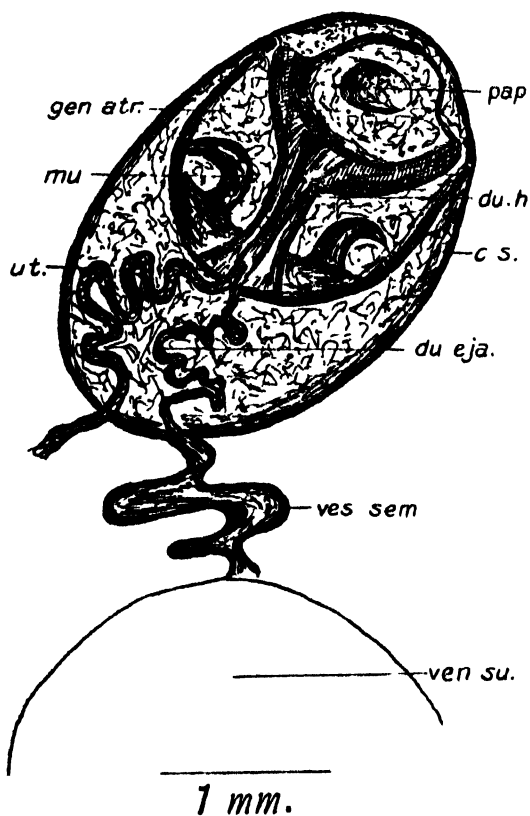
From this table it appears that both these forms are identical in all respects, except that in *Isoparorchis trisimilitubis* the ovary is situated on the right side, while Kobayashi describes it as present on the left. This discrepancy might have arisen out of mere confusion, and a re-examination of Kobayashi's specimens might reveal the ovary to be present on the right as in other forms. The glandular stomach ("Drüsenmagen") is present also in the specimens obtained from the gas-bladder of *Wallago attu*, but Southwell failed to notice it.

These forms, therefore, which have been obtained from the gas-bladders of Siluroid fishes from different localities, and which have been described by two authors as two distinct species belonging to two different new genera, are identical. According to the law of priority, *Isoparorchis trisimilitubis* is the correct name for this species, *Leptolecithum eurytremum* falling into synonymy. The diagnosis given for *Leptolecithum* by Kobayashi (1920, p. 396) should, however, be adopted for the genus *Isoparorchis* as being more perfect and reliable. Travassos (1922, p. 230) hinted at this synonymy, but it was thought desirable to throw more light on this point as the material was available to me.

As the reproductive system has not been completely described by either of the authors, the present occasion seems suitable to supply the missing details.

*Reproductive System (Male).*—The testes are a pair of round to ovoid bodies, measuring 0.80–1.32 mm. by 0.67–1.08 mm., and lying laterally at or slightly behind the posterior border of the ventral sucker. Even in the same individual they are of different sizes. From the centre of each anterior border arises a vas efferens passing centrally anterior to the ventral sucker, where both unite to form a vas deferens. This latter soon enlarges into the vesicula seminalis, 0.15–0.17 mm. wide, which passes anteriorly, bending three to five times in mature specimens, and enters the cirrus-sac-like organ as the ductus ejaculatorius. The cirrus-sac-like organ is situated midway between the two suckers, and is inclined slightly towards the left. It is elliptical and measures approximately 3 mm. long and 1.5 mm. broad. At its anterior end is a depression—the genital atrium,—which opens to the exterior by means of a genital pore situated between the two suckers, slightly behind the intestinal fork. At its posterior end enters the uterus. Both the uterus and the ductus ejaculatorius wind in it several times and ultimately meet together to form a ductus hermaphroditicus. This latter enters the genital atrium, where it becomes enveloped by a

very thick musculature, bearing at its end a conical papilla on which the ductus hermaphroditicus opens. The conical papilla is capable of being protruded through the genital pore. Attaching the muscular organ to the walls of the cirrus-sac



The contents of the cirrus-sac of *Isoparorchis trisimulitubis*.

- |                                |                              |
|--------------------------------|------------------------------|
| c.s. Cirrus-sac.               | pap. Papilla.                |
| du.h. Ductus hermaphroditicus. | ut. Uterus.                  |
| du.eja. Ductus ejaculatorius.  | ven.su. Ventral sucker.      |
| gen. atr. Genital atrium.      | ves.sem. Vesicula seminalis. |
| mu. Muscle.                    |                              |

are a pair of strong muscles, each curved like a bracket normally, but becoming rod-like in an expanded position.

The whole of the male genital system is very interesting, firstly, because the cirrus-sac-like organ contains not only the



male reproductive organs, but also a part of the female genitalia, namely, the uterus and vagina (it is therefore not a true cirrus-sac as in other forms); secondly, because of the strong musculature enveloping the ductus hermaphroditicus, which ordinarily is present in the case of the male copulatory organ, the cirrus. The purpose of such musculature appears to be only the ejection of the fertilised ova to the exterior, and not a copulatory one as usual.

#### REFERENCES.

- KODAYASHI, H. (1920.) "On some Digenetic Trematodes in Japan." *Parasitol.* xii. pp. 380-410.  
 SOUTHWELL, T. (1913.) "Notes from the Bengal Fisheries Laboratory, Indian Museum.—No. 1." *Rec. Ind. Mus. Calcutta*, ix. pp. 79-103.  
 TRAVASSOS, L. (1922.) "Contribuições para o conhecimento da fauna helmintológica brasileira.—XVII." *Mem. Ins. Oswaldo Cruz*, t. xv. fasc. 1, pp. 220-234.

#### XXXIV.—*On some small Mammals from Madagascar.*

By OLDFIELD THOMAS.

##### THE RACES OF *ERICULUS SETOSUS*.

In a collection recently received from Madagascar there are some examples of *Ericulus* from the Ambohitrakolahy Forest, in the east of the island, some way north of the capital.

A study of these shows that the well-known Madagascar hedgehog, *Ericulus setosus*, may be divided into three races, these being, firstly, *E. setosus setosus*, of South Madagascar (type-locality, Fort Dauphin), smallest in size and the colour comparatively light, the spines broadly white-tipped, and the belly white or whitish. Secondly, *E. setosus nigrescens*, Geoff.—type-locality not recorded, but in all probability middle Eastern Madagascar (Andevorante may be selected, as specimens are available from there); rather larger than *setosus*, the colour blackish throughout, with the spines only very narrowly tipped with whitish, the face, limbs, and belly dark brown, the bullæ not specially large. And, lastly, the form now received, which may be called

*Ericulus setosus melantho*, subsp. n.

Colour dark, as in *nigrescens*. Size still larger, the skull averaging decidedly larger than in specimens from the

middle area of Madagascar. Bullæ, as measured on a line from the condyle of one side to the posterior zygomatic process of the other, very much larger.

Skull-dimensions of the type:—

Greatest length, from condyles to gnathion, 54 mm.; greatest breadth on posterior zygomatic processes 25; inter-orbital breadth 12·4; mastoid breadth 24; palatal length 30; diameter of bulla (measured as above) 7; front of  $p^3$  to back of  $m^2$  11·2; transverse breadth of  $m^2$  5·8.

*Hab.* Ambohitrakolahy Forest, 18° 4' S., 48° 6' E., inland from Tanatave, Eastern Madagascar.

*Type.* Adult male. B.M. no. 25. 11. 7. 9. Collected February 1925. Six specimens.

By the kindness of Dr. R. Anthony I have had the opportunity of examining a skull (no. A. 7020 of the Paris Museum), which would appear to be that of Buffon's original *tendrac*, labelled as such by Geoffroy. Its palatal length is 27·5 mm.; front of  $p^1$  to back of  $m^2$  9·6; transverse diameter of  $m^2$  5·0.

None of the original skulls of Geoffroy's *niqrescens* seem to have been preserved, and a type-locality for that form has to be arbitrarily fixed upon.

## TWO NEW SPECIES OF *MICROGALE*.

### *Microgale principula*, sp. n.

Most nearly allied to *M. longicaudata*, with which it shares the excessive length of the tail, whose tip is similarly modified for prehension. But the size is larger throughout, the skull more robust, with more tendency to lambdoid ridges and zygomatic projection, and the teeth are larger and heavier.  $P^4$  has a well-marked anterior basal cingular cusp. Premolars and molars broader transversely than in *longicaudata*, with well-developed internal lobes.

Colour, so far as can be judged on spirit-specimens, as in *longicaudata*—that is, uniformly buffy above and below, with slaty bases to the hairs. Tail wholly blackish, not or scarcely lighter below, its exceedingly fine hairs silvery brown; the hairless prehensile portion below the tip about 15 to 20 mm. in length.

Dimensions of the type (measured on the spirit-specimen):—

Head and body 73 mm.; tail 157; hind foot 20; ear 15.

Skull: greatest length 25; condylo-basal length 24; greatest breadth 10; interorbital breadth 5; palatal length 12; front of  $p^4$  to back of  $m^2$  4.

*Hab.* South-east Madagascar. Type from Midongy-du-Sud.

*Type.* Adult female. B.M. no. 25. 8. 3. 15.

This fine species is decidedly larger than its relative, true *Microgale longicaudata*, the extra long and prehensile-tailed species represented in Mr. Deans Cowan's original series only by the type and one other specimen. From that the smaller *M. majori*, previously confused with it, was separated in 1918, when a revision of all the group was published\*. In this revision the large species that had been described as *M. dobsoni* and *talazaci* were removed into the new genus *Nesogale*, so that next after the short-tailed species *M. thomasi*, Maj., the present long-tailed species is the largest of the restricted genus *Microgale*.

Further, another *Microgale* from the more northern part of the island may be described as follows:—

*Microgale sorella*, sp. n.

Related to both *M. longicaudata* and *principula*, but intermediate in size.

Size, as gauged by skull, smaller than in *principula*, larger than in *longicaudata*. Colour and general characters about as in these species, and with similarly elongate prehensile-tipped tail.

Dimensions of the type:—

Head and body 71 mm. ; tail 156 ; hind foot 19·5 ; ear 14·5.

Skull : greatest length 23·6 ; condylo-basal length 23·1 ; greatest breadth 9·5 ; interorbital breadth 5 ; palatal length 10·8 ; front of  $p^4$  to back of  $m^2$  4.

*Hab.* Beforona Forest, inland of Andavorante, Eastern Madagascar.

*Type.* Adult male. B.M. no. 25. 8. 3. 14.

In view of the constancy in size of skull shown by other species, and the considerable distance between the two localities, with *M. longicaudata* coming between, I think there is no doubt this more northern long-tailed species should be distinguished from the southern *M. principula*.

XXXV.—*Papers on Oriental Carabidæ*.—XVI.

By H. E. ANDREWES.

IN this paper I am dealing with some further questions of synonymy which I have come across during the past year or two, and also describing a few new species, several of which had previously been misidentified. I have to thank Mr. Lesne,

\* Ann. & Mag. Nat. Hist. (9) i. p. 302.

of the Paris Museum, Dr. Gestro, of the Genoa Civic Museum, and Mr. Csiki, of the Buda-Pest Museum, for the loan of various specimens. I am also under a considerable obligation to Dr. K. M. Heller, of the Dresden Zoological Museum, who has been kind enough to send me for examination the whole of the types of species described by him during recent years from the Philippine Islands, together with a number of other specimens. I take this opportunity of thanking him for his courtesy.

*Oxylobus punctatosulcatus*, Chaud., var. *meridionalis*, Bates, Compt. rend. Soc. Ent. Belg. 1891, p. 325 (note).

Bates's variety is quite distinct from *punctatosulcatus* and must be treated as a separate species. In addition to the two typical specimens in Mr. R. Oberthür's collection, there are two examples in the British Museum. Unfortunately none of the labels gives an exact locality for the species.

*Epicosmus hilaris*, Lesne (not Chaud.), Mission Pavie Hist. Nat. 1904, p. 69.

The unique example is labelled "Siam, Battambang, A. Pavie, 1886," and differs in many respects from Laterté's species. I therefore describe it under the name of

*Craspedophorus lesnei*, sp. n.

Length 11.0 mm.; width 4.3 mm.

Black, with two orange spots on each elytron, the front one extending from stria 3 to the middle of the epipleura, the hind one between striae 3 and 8.

*Head* small, surface uneven, rugose-punctate, constriction deep, neck and clypeus smooth, eyes hemispherical, antennae long and slender, palpi slender, last joint of labials securiform but a good deal longer than wide. *Prothorax* transverse, about twice as wide as head, coarsely rugose-punctate, the punctures larger on disk and much larger than those on head, sides strongly rounded and much contracted in front, so that front angles adjoin neck, less contracted and a little reflexed behind, so that base is nearly twice as wide as apex, hind angles obtuse, with a small, sharp, rectangular tooth; median line fine but distinct, basal foveae moderately impressed. *Elytra* oval, moderately convex, a little wider than prothorax, striae fairly deep and clearly punctate, intervals convex, rather finely and not very closely punctate, the punctures coalescing a little laterally. *Underside* coarsely, but middle of venter finely punctate, metepisterna half as long again as wide, front margin of ventral segments crenulate.

Much smaller than *C. hilaris*, Laf.; head smaller and more finely punctate, last joint of palpi less dilated; prothorax more evenly rounded at sides, the apex relatively narrower, the tooth at hind angles larger; elytra with deeper striæ and more convex intervals, front orange spot reaching stria 3 (in *hilaris* it reaches 2).

*Peronomerus nigrinus*, Heller (not Bates), Deutsch. Ent. Zeitschr. 1916, p. 276 = *P. fumatus*, Schaum.

*Trichixia chinensis*, Csiki, Ann. Mus. Hung. 1907, p. 576 = *T. cyanea*, Schaum.

*Apotomus sumbawanus*, Heller (not Dupuis), Deutsch. Ent. Zeitschr. 1916, p. 275.

Both the original description and the picture in Wytsmann's 'Genera Insectorum' indicate a long hairy covering on Dupuis's species, reminiscent of *A. hirsutulus*, Bates. In Dr. Heller's example there is, apart from the long marginal setæ, only a short close pubescence, and I think it identical with *A. fuscus*, Motsch. = *A. xanthotelus*, Bates.

*Chlœnius cuspidatus*, Heller, Phil. Journ. Sci. 1923, p. 301.

I have in my collection a specimen from Hongkong, already compared with *C. guttula*, Chaud., and Dr. Heller's example differs only in having an arrow-head-shaped instead of an oblong light spot at the apex of the elytra.

*Datascelis ceylonicus*, Motsch. Bull. Mosc. 1861, i. p. 103.

I have seen no typical example of Motschulsky's species, but, judging by the description, there seems no reason to suppose that it differs in any way from *Pachytrachelus oblongus*, Dej.

*Calathomimus vittatus*, sp. n.

Length 10·0 mm.; width 3·5 mm.

Piceous, underside somewhat iridescent; sides of prothorax and a vague stripe, about two intervals wide, sub-interrupted at middle, extending from shoulder to near apex, brown; antennæ and legs ferruginous.

Head convex, frontal foveæ small and rounded, a faint oblique line on each side, extending from them towards eyes, which are flat, antennæ reaching basal fourth of elytra.

*Prothorax* rather flat, quadrate, apex emarginate, front angles projecting but a little rounded, sides very gently and evenly rounded, but contracted rather more in front than behind, a single seta at apical third, hind angles a little obtuse but strongly rounded; median and transverse impressions very faint, the foveæ very shallow, with traces of very fine puncturation, surface otherwise smooth. *Elytra* elongate-ovate, as wide at base as prothorax, widening gently behind and widest a little behind middle, basal border bisinuate, forming an acute angle at shoulder; striæ deep, impunctate, 2 not reaching base but joining the short scutellary stria, intervals convex, 3 with a series of about a dozen pores, adjoining stria 2. *Underside* smooth, epipleuræ of elytra somewhat hollowed out in front, metepisterna hardly longer than wide.

Compared with *C. maculatus*, Bates, the eyes are not quite so flat, the frontal furrows not so deep and punctiform; prothorax flatter, more narrowly bordered, the sides more parallel and the hind angles consequently only slightly obtuse though rounded, the surface smooth; elytra less rounded at sides, border making an even more acute angle at shoulder, striæ shallower though still deep, and intervals less convex, only 3 with a row of punctures, pattern formed by a brown lateral stripe.

CEYLON: Woodside, Urugalla (*G. M. Henry*), 1 ex., ♀. By the desire of the Director of the Colombo Museum the type has been placed in the British Museum.

*Stenolophus chaldeus*, Lesne (not Bates), Mission Pavie Hist. Nat. 1904, p. 76.

This example has not the brassy upper surface, rounded prothorax, and brown antennæ of *chalceus*. I regard it as one of the numerous forms of *S. smaragdulus*, F., an extremely variable species, especially in its elytral pattern.

*Triplogenus mouhoti*, Bates, Ann. Mus. Civ. Gen. 1892, p. 356; Tchitch. Hor. Soc. Ent. Ross. xxxiv. 1900, pp. 173 (note) & 175.

Tchitcherine thought that his *Lesticus nubilus* was probably identical with *mouhoti*, Bates, which he considered a misidentification. I have compared Tchitcherine's type with an example of *mouhoti*, Bates, from Bhamo, and consider them distinct. *E. nubilus* from Cochin China is a larger wider insect, the head nearly black, the prothorax very dark green (instead of both being a fairly bright green); the prothorax

is less contracted behind and the border is thicker, but the principal difference is in the basal foveæ, the surface of which is coarsely rugose-punctate (instead of finely and closely punctate-rugose); the elytra are more dilated behind, but do not otherwise differ.

When I was at Rennes I had the opportunity of comparing an example of *L. mouhoti*, Bates, ♀, with Chaudoir's male type. I noticed some slight differences, which may have been partly individual and partly sexual; until further investigation is possible I propose to treat Bates's identification as correct.

*Abacetus impictus*, Tchitch. Hor. Soc. Ent. Ross. xxxv. 1901, p. 57 = *A. ampicollis*, Bates, Ann. Mus. Civ. Gen. 1889, p. 106.

Although I have not seen Tchitcherin's type, his description is detailed and agrees very well both with co-types of Bates's species and with other examples in my collection from various parts of North India.

*Abacetus maculipes*, Bates (not Chaud.), Ann. Mus. Civ. Gen. 1892, p. 361; Andr. Trans. Ent. Soc. Lond. 1921, p. 148.

Two specimens which Dr. Gestro has kindly sent me from Genoa have no resemblance to Chaudoir's species, which is smaller, narrower, brassy in colour, with pale legs; I regard it as a new species, and propose for it the name of *A. batesi*. In appearance and size it is extremely like *A. amplipennis*, Bates, mentioned above, black, without apical spot, the antennæ fuscous except joints 1 and 2, the legs ferruginous, the femora darker in middle than at apex. The frontal impressions curve outwards towards eye, as in *amplipennis*, but curve inwards again behind. The prothorax is similar in shape, transverse and with strongly rounded sides, but the marginal channel is much narrower, the median line more strongly impressed, the basal foveæ similarly parallel, with punctures between them. The elytra differ only in having the striæ, which are fairly deep and impunctate, less impressed towards apex.

BURMA: Karin Asciuii Cheba, 1200-1300 m. (*L. Fea*), 2 ex. Type in the Genoa Civic Museum.

*Sphodrus cordicollis*, Bates (not Chaud.), Scient. Res. of Second Yarkand Mission, Col. 1891, p. 11 = *Pristonychus kashmirensis*, Bates, var. *babaulti*, Andr.

*Sphodrus* is no doubt a slip of the pen for *Pristonychus*,

but it is difficult to surmise why Bates should have gone out of his way to compare the example with *P. cordicollis*, Chaud., which it does not nearly resemble, when he had himself recently described the species from Kashmir.

*Peanus spinipennis*, Bates, Ann. Mus. Civ. Gen. 1889, p. 108.

In this species the femora are flavous, with the apex infuscate, but there is another form in which they are wholly black, which gives the insect quite a different appearance. For this I propose the name of *nigripes*, var. nov. The typical form occurs in Assam, Burma, and Indo-China, the variety in various parts of India; both forms occur in Ceylon.

*Colpodes sebosus*, sp. n.

Length 7.0 mm. ; width 2.75 mm.

Piceous, the elytra with a somewhat greasy appearance; margins of prothorax and elytra, elytral epipleuræ, palpi, antennæ (darker towards apex), and legs fulvous.

*Head* convex, smooth, with short but fairly deep frontal impressions, extending on to clypeus, eyes rather flat, genæ sloping gradually to neck, antennæ slender, reaching basal third of elytra. *Prothorax* a little transverse, moderately convex, base with its sides oblique, about as wide as apex, sides very narrowly bordered, bisetose, rounded in front, vaguely sinuate behind, hind angles obtuse, rounded, and reflexed; median line faint, basal foveæ adjoining angles, fairly deep, diverging in front, surface smooth but vaguely transversely striate. *Elytra* convex, ovate, fully half as wide again as prothorax and as much longer than wide, widest just behind middle, strongly contracted in front, where the border forms an obtuse angle at shoulder, and with well-rounded sides, the border sinuate before apex, where there is a well-marked re-entrant angle; striæ very shallow, vaguely crenulate, intervals flat, 3 with three punctures, first adjoining stria 3, the others adjoining stria 2, marginal series interrupted, surface smooth. Micro-sculpture nearly isodiametric, very faint on prothorax. *Underside* smooth, metasternal process bordered, metepisterna a little longer than wide, last ventral segment ♂ with one seta, ♀ with two setæ on each side; tarsal joints not grooved, joint 4 in protarsi bilobed, though not split to base, emarginate in meso- and metatarsi.

In shape not unlike *C. bengalensis*, Chaud., though much smaller and otherwise coloured. I know of no nearly allied species, but the strongly rounded, faintly striate elytra, with



the subangular border at shoulder, will easily distinguish it from any other Singhalese *Colpodes* at present known.

CEYLON: Pidurutalagalla (*G. M. Henry*), 5 ex. By the desire of the Director of the Colombo Museum the type has been placed in the British Museum.

*Anchomenus nigrosericans*, Heller, Phil. Journ. Sci. 1923, p. 298 = *A. quadripunctatus*, Deg.

I cannot regard this as more than a form of this very widely distributed and variable palæarctic species, though the silky gloss and other characters mentioned by Dr. Heller give it a somewhat unusual appearance. In Europe it is taken, at all events at low levels, in recently burnt pine-woods, but it occurs also at great elevations and has been taken at 15,000 feet in the Himalayas. Dr. Heller's specimen from the Philippine Islands was taken on Mount Santo Tomas, and, I suspect, fairly high up. Examples were found in Japan both by Mr. C. Maximowicz and Mr. George Lewis.

*Perigona ruficollis*, Motsch., var. *nana*, Bates, Ann. Soc. Ent. Fr. 1889, p. 273; Andr. Trans. Ent. Soc. Lond. 1921, p. 178.

I have now seen Putze'y's type of *P. plagiata*, and find that Bates's var. *nana* agrees with it exactly. *P. ruficollis* appears to be quite a distinct species.

*Macrochilus ruficollis*, Heller, Phil. Journ. Sci. 1923, p. 296, t. i. fig. 1 = *M. chaudoiri*, Andr.

*Creagrís affinis*, Gestro, Ann. Mus. Civ. Gen. 1875, p. 870, fig. = *C. labrosa*, Nietn.

Nietner's species is widely distributed, and I have seen examples from South India, Ceylon, Burma, Java, Siam, and Australia. The form of the prothorax seems in this species a little variable, but I was not able to see in Dr. Gestro's type, which he very kindly sent me for examination, any characters to permit of its separation from *labrosa*.

*Anaulacus sericipennis*, MacL., var. *philippinensis*, Heller, Phil. Journ. Sci. 1923, p. 302, t. i. fig. 2.

Dr. Heller is inclined to regard both *fasciatus*. Schm.-Goeb., and his own *philippinensis* as subspecies of *sericipennis*. No doubt *fasciatus* is closely allied to *sericipennis*,

but I think it is entitled to specific rank, and, moreover, I think the Philippine form better treated as a variety of it than of *sericipennis*. Another closely allied form (*basalis*, Fleut.) occurs in Indo-China.

*Catascopus aeneus*, Saund. Trans. Ent. Soc. Lond. 1863, p. 467, t. xvii. fig. 2; Andr. Trans. Ent. Soc. Lond. 1921, p. 149.

This species and its near allies have caused me some perplexity. When first I was at Rennes I saw a *Catascopus* which I understood to be the type of *aeneus*. This proves to be a mistake, and my remarks regarding it must therefore be withdrawn. I think now that *costulatus*, Chaud., must be put in synonymy with *presidens*, Thoms. = *splendidus*, Saund.

It may be of interest to record here that four of Saunders's types, which should be in Mr. René Oberthür's collection, are, in fact, not to be found there; these are, *Catascopus aeneus*, *rugicollis*, *levipennis*, and *Holcoderus* (*Catascopus*) *elongatus*.

Genus HOPIOMENES, Heller, Phil. Journ. Sci. 1921, p. 528 = *Aristolebia*, Bates, Ann. Mus. Civ. Gen. 1892, p. 428.

### XXXVI.—Hemiptera-Heteroptera new to Rodriguez. By W. E. CHINA.

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SINCE the appearance of my paper on the Heteroptera of Rodriguez (Ann. & Mag. Nat. Hist. (9) xiv. pp. 427-453, Oct. 1924) I have received a further small collection from that island, made by Mr. G. C. Addison-Williamson, which includes several species not previously recorded. The new records are as follows:—

#### Family Pentatomidæ.

##### *Nezara heegeri*, Fieb.

1861. *Acrosternum heegeri*, Fieber, Eur. Hemipt. p. 331.

1861. *Rhaphigaster incertus*, Signoret, Ann. Soc. Ent. France, p. 935.

1864. *Nezara incerta*, Stål, Hemipt. Afr. i. p. 192.

1866. *Nezara heegeri*, Mls. & Key, Hist. nat. des punaises de France, Paris, ii. p. 292.

2 ♀ ♀, Rodriguez Is. (G. C. Addison-Williamson).

Widely distributed over the Mediterranean and Ethiopian Regions, and extending as far as Madagascar.

*Mecidea quadrivittata*, Sign.

1851. *Cerataulax quadrivittata*, Signoret, Ann. Soc. Ent. France, (2) ix. p. 336.

1864. *Mecidea quadrivittata*, Stål, Hemipt. Afr. i. p. 133.

A badly damaged specimen apparently belonging to this species.

Recorded from Mauritius.

## Family Coreidæ.

*Hypselopus villosipes*, Am. & Serv.

1843. *Meloza villosipes*, Amyot & Serville, Hémiptères, p. 221.

1865. *Hypselopus villosipes*, Stål, Hemipt. Afr. ii. p. 99.

1 ♀, Rodriguez Island (G. C. Addison-Williamson).

Previously recorded from Mauritius.

## Family Reduviidæ.

*Oncocephalus annulipes*, Stål.

*Oncocephalus annulipes*, Stål, Cefv. Vet.-Ak. Förh. 1855, p. 44.

1 ♂, Rodriguez Island (G. C. Addison-Williamson).

Originally described from Natal, but since recorded from the Indian, Oriental, Malayan, and Australasian Regions by various writers. Judging by the heterogeneous collection under this species in the British Museum, it would appear that Reuter was right in restricting this species to the South African Region.

Mr. Addison-Williamson also took specimens of the following previously recorded species:—

*Macroscytus privignus*, Horv.

*Iethæus longirostris*, Reut.

*Oicada thomasseti*, China.

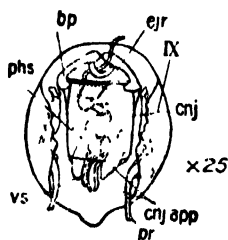
XXXVII.—*A Note on some Species of Homœocerus (Hemiptera-Heteroptera, Coreidæ)*. By HEM SINGH PRUTHI, Ph.D.

(From the Zoological Laboratory, Cambridge.)

DISTANT, in the 'Fauna of British India, Rhynchota,' vol. i., created a new species—*Homœocerus rosaceus*—allied to *H. variabilis*, Dall. Kiritshenko (Ann. Mus. Zool. Ac. Sci. Petrograd, xix. 1914, p. xxvii) in a short note doubted the justifiability of Distant's conclusions. Such a dispute can

be readily settled by the examination of the sexual armature, and the late Mr. E. A. Butler, aware of my interest in the study of these organs, sent me specimens of the two species for the examination of their genital organs. I have examined these structures, and find them *absolutely identical* (fig. 1). Thus Kiritschenko's views are confirmed. Moreover, I possess specimens collected at Lyallpur (Punjab, North India) from the same food-plant (*Acacia arabica*), the bigger ones of which correspond with Distant's description of *H. variabilis* (and also agree closely with the examples of that species sent to me by Mr. Butler), while the smaller ones answer to that of *H. rosaceus*; there are some examples intermediate in size which connect the two forms by gradations. It may be added that the habitat of *H. variabilis*, as given in the

Fig. 1.



Ninth abdominal segment, parameres, and aedeagus of  
*Homœocerus variabilis* and *H. rosaceus*.

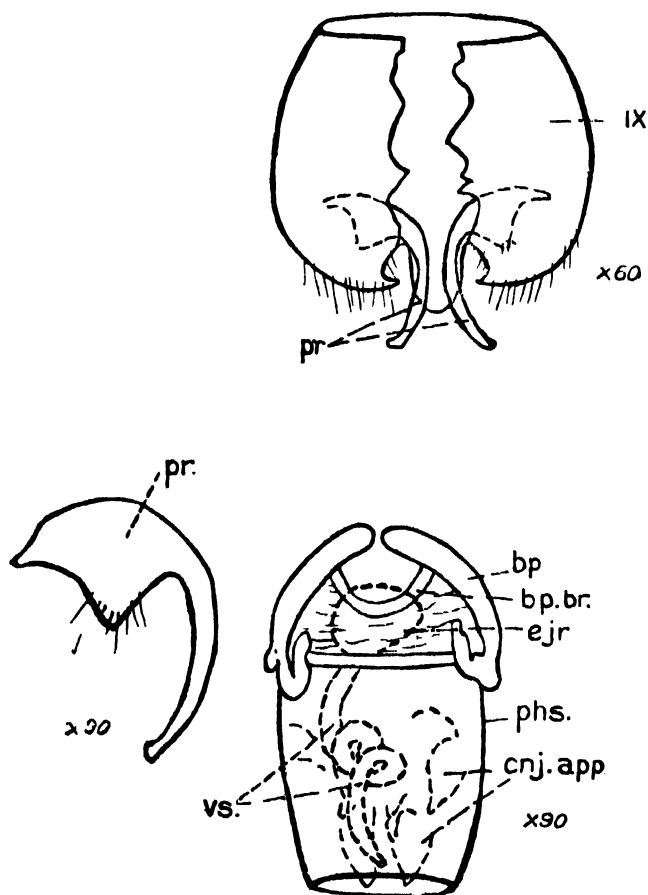
Lettering to all the figures:—*aed.*=aedeagus; *bp.*=basal plates; *bp.br.*=basal plates bridge; *cnj.*=conjunctiva; *cnj.app.*=conjunctiva appendages; *ejd.*=ejaculatory duct; *ejr.*=ejaculatory reservoir; *pr.*=parameres; *phs.*=phallosoma; *vs.*=vesica.

'Fauna' volume above referred to, is North India, while *H. rosaceus* is recorded by Distant from Sind, about 350 miles from Lyallpur.

That the *bona fide* species of *Homœocerus* distinctly differ from one another in the anatomy of the sexual armature is clear from an examination of figs. 2, 3, and 4, which illustrate these organs in *H. graminis*, Fabr., *H. albiguttulus*, Stål, and *H. limbatipennis*, Stål, respectively. The examples of *H. graminis* were given me by Mr. Butler, and are from South India. Those of the other two species were determined by Distant and are in the Cambridge Museum; in both cases they are from the Malay Peninsula (Skeat Expedition). The different species can be at once distinguished

by the form of the parameres and the shape of the ninth abdominal segment. Moreover, as will be noted on a closer study of the figures, the vesica and the form and number of

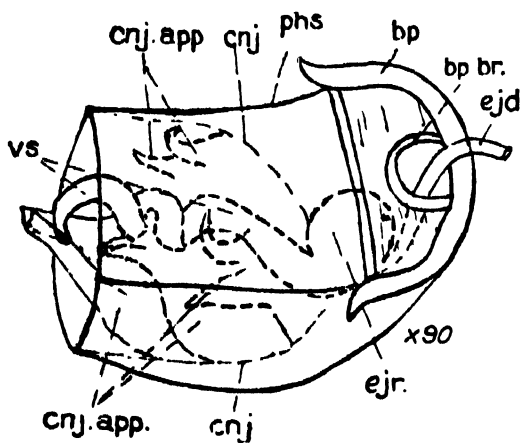
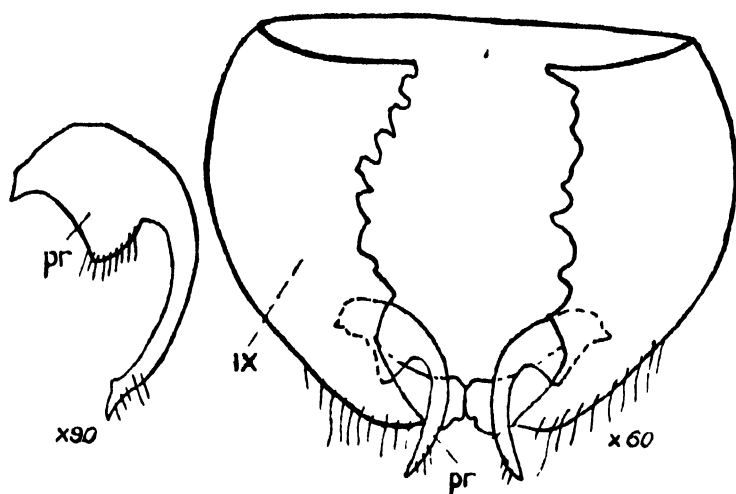
Fig. 2.



Ninth abdominal segment, parameres, and aedeagus of  
*Homocidus graminis*.

the conjunctiva appendages are also characteristic of each species. For the explanation of the terminology, reference should be made to my recent paper, "Morphology of the

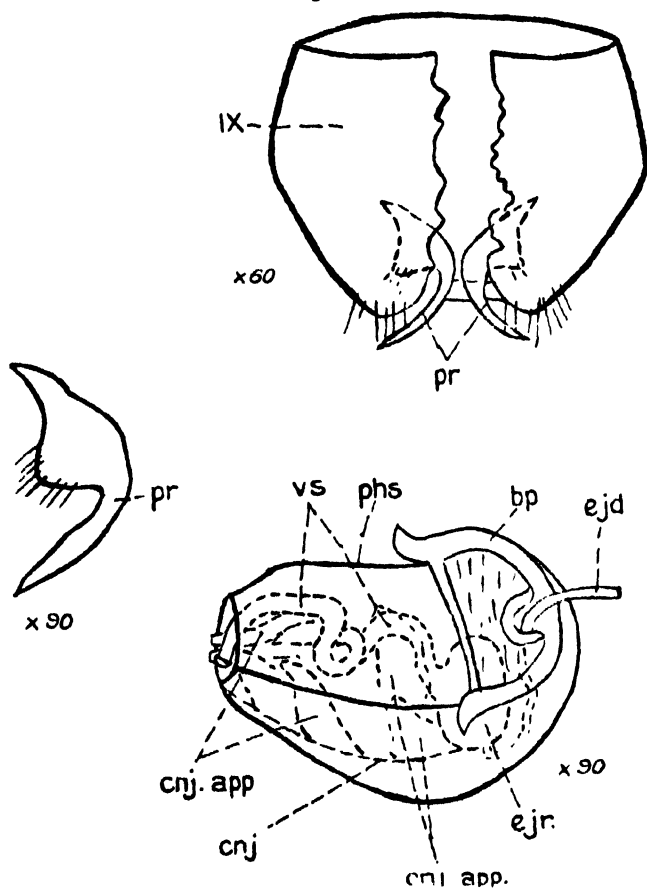
Fig. 3.



Ninth abdominal segment, parameres, and aedeagus of  
*Homœocerus albiputillus*.

Male Genitalia of Rhynchota" (Trans. Ent. Soc. London, 1925).

Fig.4.



Ninth abdominal segment, parameres, and aedeagus of  
*Homocerus limbipennis*.

My sincere thanks are due to the late Mr. E. A. Butler and to Dr. Hugh Scott for giving me valuable material.

XXXVIII.—*The Relation between Spongin and Spicule in the Haploscleridæ.* By MAURICE BURTON, M.Sc., Research Student of King's College, University of London.

BEFORE we can hope to place the classification of the Haploscleridæ on a sound basis, we must recognise fully the anomalies of our present ideas of taxonomy in this group. There can be no doubt that many genera have been erected in the past—some of which have been abandoned already—whose diagnoses represented nothing more than extremes of variation within already existing species of other closely-allied genera. This may be said, particularly, of those genera whose diagnoses are founded, exclusively in some cases, on the quantitative relation between the spicules and the spongin of which the skeleton is composed.

As far back as 1866, Bowerbank, in his 'Monograph of British Spongiada' (p. 362), pointed out that in a single specimen of *Chalina oculata* the amount of spongin present in the skeleton varies considerably from one part of the sponge to another, and from his remarks it is evident that the skeleton may resemble that of a *Reniera* near the surface and towards the ends of the branches, that of a *Ceraochalina* in the stalk, while throughout the rest of the sponge it resembles that of a true *Chalina*. My observations on the same species have led me further than this. In passing from one individual to another the variation in the skeleton is such that one specimen may be safely placed in the genus *Chalina*, another in *Pachychalina*, and a third in *Ceraochalina*. Yet all specimens will be obviously co-specific when judged by external form, habitat, colour, &c. In one case, a specimen found on the beach at Hastings, differing in no other respect from a typical *Chalina oculata*, possessed no spicules at all, the skeleton being composed entirely of spongin. Although I have examined many beach-worm specimens, I have never found one in which maceration had resulted in the complete loss of the megascleres. It appears probable, therefore, that this common species may develop, under certain circumstances, the skeleton of a *Chalinopsilla*.

Ridley and Dendy (1887, p. 25) observe: "It (*Pachychalina pedunculata*) . . . shows how little value can be placed upon the amount of spongin present for purposes of classification." Hentschel (1911A, p. 318) points out



that the relation between spongin and spicules in *Homoeodictya staurophora* varies considerably, the fewer the spicules the more spongin in the fibre of the skeleton. Referring to *Reniera simulans* (Bwk.), Stephens (1921, p. 8) remarks: "Sometimes a considerable quantity of spongin is present." On the other hand, nowhere, to my knowledge, has an attempt been made to demonstrate fully the extent of the relative variation of these two skeletal elements.

Again, we have the curious spectacle of certain species being relegated first to one genus and then to another closely-related genus, notably *Cladochalina pergamentacea*, Ridley (1884c), referred to the genus *Chalina* by Ridley and Dendy (*l.c.*), and Dendy (1895), and to the genus *Ceraochalina* by Dendy (1924). Many examples of a similar kind might be quoted, but concerning this one it is of interest that in a group of specimens, clearly belonging to this species, sent from S. Africa by Dr. J. D. F. Gilchrist, two could be placed in *Chalina*, one in *Pachychalina*, and the last in *Ceraochalina*. I have made similar observations on numerous examples of *Chalina montaguui*, Bwk., from Littlehampton.

Briefly, I regard the genera *Reniera*, *Chalina*, *Pachychalina*, *Ceraochalina*, and, possibly, *Chalinopsilla*, as diagnosed by Dendy (1921b), whose diagnoses probably express the generally accepted views on the subject, as representing nothing more than the normal variations which may occur within a single species. If such a view appears drastic, it is solely because we have grown accustomed to accepting the erection of species and genera in the Haploscleridæ on trivial points of difference in the skeleton. When some hundreds of specimens are examined and carefully compared, as I have done, it becomes obvious almost to a point of absurdity that the new idea I have expressed is correct; and that it is a case closely analogous to the partial or complete loss of microscleres in other genera of Tetraxonida, numerous examples of which might be quoted.

In support of my view, it may be added that I have found Row's specimens of *Siphonochalina tubulosa* from the Red Sea to vary from truly Chalinoid to Pachychalinoid or Ceraochalinoid; the numerous specimens of *Chalina polychotoma*, described by Carter and Dendy, vary from Renieroid to Chalinoid, Pachychalinoid, and Ceraochalinoid; and, in rare cases, to what is practically Chalinopsilloid\*.

\* I use the terms Renieroid, Chalinoid, &c., as expressing the possession of a skeleton similar to that defined by Dendy (1921b), as the diagnoses of the genera *Reniera*, *Chalina*, &c.

Similar variations were found in groups of specimens from S. Africa of *Siphonochalina communis* (Ctr.) and *Pachychalina punctata* (Ridley & Dendy). In other groups of sponges parallel cases were observed, notably in the isodictyal skeleton of *Desmacidon grande* (R. & D.).

I am not prepared to say that all species of Haploscleridæ exhibit the same wide range of variation in the skeleton which I have observed in the species referred to above, but to understand the Haploscleridæ the limits of fluctuation must be carefully noted and defined by broad comparative examination of a large number of specimens, wherever possible. Moreover, I do not profess to be able to lay down, as yet, definite rules as to the limits of variation in a species or genus; but I do strongly recommend the study of the variation of the skeleton as a possible avenue of approach to the solution of the riddle of the Haploscleridæ, and the consequent restoration of order in the present chaotic state of that group. Perhaps one of the most convenient methods of defining genera will be found in the characters of the dermal skeleton (*cf.* Topsent, 1924), which appears to be one of the most stable of all characters. Between species much may be made of the external form and the characters of the oscules, both variable within fairly narrow limits, and the combination of these characters with those of the skeleton.

#### LIST OF LITERATURE REFERRED TO.

1895. DENDY, A. "Collection of Non-calcareous Sponges collected by J. B. Wilson, Esq., M.A., in the Neighbourhood of Port Phillip Heads." Pt. I. Proc. Roy. Soc. Victoria, vol. vii. pp. 232-260.
- 1921 n. —. "Report on the Sigmatotetraxonida collected by H.M.S. 'Sealark,' &c." Trans. Linn. Soc., Zool. vol. xviii. pp. 1-164.
1924. —. "Porifera. Pt. I. Non-Antarctic Sponges." British Antarctic ('Terra Nova') Expedition, 1910, Zoology, vol. vi. no. 8, pp. 269-392.
- 1911 a. HERTSCHEL, E. "Tetraxonida. Th. 2." Die Fauna Südwest-Australiens. Bd. iii. pp. 279-393. Jena, G. Fischer.
- 1884 c. RIDLEY, S. O. "Spongiida." Report on the Zoological Collections made in the Indo-Pacific Ocean during the Voyage of H.M.S. 'Alert,' 1881-2.
1887. RIDLEY, S. O., and DENDY, A. "Report on the Monaxonida." 'Challenger' Reports, Zoology, vol. xx.
1921. STEPHENS, J. "Sponges of the Coasts of Ireland. II. The Tetraxonida" (concluded). Fisheries, Ireland, Sci. Invest. 1920.
1924. TOPSENT, E. "Révision des Mycale de l'Europe occidentale." Ann. de l'Institut Océan. Tome i. Fasc. iii. pp. 77-116.

## BIBLIOGRAPHICAL NOTICES.

*A Handbook of the Birds of Eastern China.* By J. D. D. LA TOUCHE, C.M.Z.S. etc. Part II. Pp. 97-192, pls. iv.-vii. London: Taylor & Francis, 1925. Price 7s. 6d.

THE present part of Mr. La Touche's work includes the dippers, thrushes, flycatchers, and shrikes; and, with the exception of certain minor alterations in the arrangement of their families, Mr. La Touche still adheres to the classification adopted by Mr. Stuart Baker in the 'Avifauna of British India.'

The arrangement of families is always a matter of some difficulty, as it is impossible to arrange these in a consecutive form to embrace all the connections we should like them to do. The author's arrangement is, however, natural and easy to understand. Since, however, Mr. Baker's second volume of the 'Avifauna' appeared, there are certain amendments which have been found necessary in his nomenclature. For instance, *Stoparola melanops* is no longer tenable, as it has been ascertained that *Muscicapa melanops*, of Vigors, is pre-occupied by *Muscicapa melanops* of Vieillot. The name will, therefore, have to be *Stoparola thalassina*, of Vigors, of which the Chinese race has already been given a separate name.

We note that Mr. La Touche still talks of subspecies hybridizing, though in this number of his work he is led into speaking thus in quoting Stresemann. He apparently agrees with the latter that *Turdus ruficollis ruficollis* and *Turdus ruficollis atrogularis* are subspecies only, and then states that hybrids between these two forms are very numerous. We ourselves consider the two forms of thrush to be perfectly good species and we have never seen any adult specimens which could not definitely be assigned to one or the other. If, however, these are held to be a subspecies, they could not possibly hybridize, although in intermediate areas intermediate specimens may be numerous.

Mr. La Touche's notes on the rock-thrushes deserve specially careful reading, as they refer to a species which has never previously been worked out and his deductions may be the right answer to the riddle they have hitherto presented.

The portion of the work under review shows that the author has expended much careful thought and great care before forming any of his conclusions; these are, therefore, always worthy of most careful consideration by brother ornithologists. His work is not only scientific but is well written and extremely readable; and we are sure, as we remarked when the first part appeared, that Mr. La Touche's volume when complete will most worthily fill a gap which has long existed in the shelf of every ornithologist who works on Oriental birds, whilst much of it is almost equally necessary to the palaearctic worker.

*The Vertebrate Skeleton from the Developmental Standpoint.* By J. S. KINGSLEY. Published by John Murray, London, 1925. Pp. 337, with 324 text-figures. Price 21s. net.

LIKE his previous useful work on the Comparative Anatomy of Vertebrates, Prof. Kingsley's new volume on the Vertebrate Skeleton is based mainly on embryology. It is intentionally descriptive, without any special dissertations on lines of descent. It is also conservative in nomenclature, and contains only four new terms applied to the parts of the primitive vertebra. Whenever possible, palæontology is made to confirm and extend the teachings of embryology, and when interpretations seem doubtful and need further study they are always specially noted. The illustrations are well chosen and beautifully clear, and those provided by embryology and palæontology are especially helpful.

After a short general introduction on the nature of the vertebrate skeleton, Prof. Kingsley begins with the exoskeleton, and then treats successively of each section of the endoskeleton. Under each section the developments through the various classes of vertebrates are traced. The descriptions are illustrated by several explanatory diagrams as well as actual drawings, and in cases where the living animals (*e. g.*, amphibians) are too specialized to show fundamental features reference is made to their generalized forerunners as known by fossils. The references to extinct animals are usually excellent, but the description of the lower jaw of the Palæozoic shark *Helicoprion* as "greatly elongate and spirally coiled" is due to a misconception.

The volume concludes with a valuable bibliography, which includes some of the older as well as the later works and papers. Among omissions we would only mention Ridewood's important memoir on Elasmobranch vertebræ in the Phil. Trans. Roy. Soc. 1921 and Stensiö's recent papers on the cranium in early fossil fishes.

We would commend Prof. Kingsley's volume not only to the beginner in the study of vertebrates, but also to any zoologist who desires a concise work of reference on the subject.

*The Osteology of the Reptiles.* By S. W. WILLISTON. Edited by W. K. GREGORY, Harvard University Press. Oxford University Press, Humphrey Milford. Price 18s. 6d. net.

APART from its exceptional intrinsic merit, this book possesses an added interest. Death overtook its author before he had completed his work; palæontologists and zoologists will be deeply grateful to Prof. Gregory and his helpers for the kindly way in which they have treated the original text, for, while supplying

many of the deficiencies naturally inherent in an incomplete and unrevised manuscript, they have succeeded in giving us a book which is essentially Williston's. Errors, advances in our knowledge since the writing of the text, and minor omissions have been remedied by footnotes; but, where no manuscript existed, no attempt has been made to supply the deficiency. Instead, references to the subject in other portions of the book have been noted, and figures supplied for purposes of comparison.

The first section of the book is devoted to an account of the skeleton; its constituent bones are considered separately and comparatively throughout the class, and, in addition, comparative accounts of the skull in several of the more important orders are also given. The second part of the book is an account of the classification and range of reptiles; in addition to a synopsis of the classification, a brief diagnosis of each subclass, order, and family is given, together with some mention of the more important genera and their distribution. The whole work is exceptionally well illustrated.

The usefulness of the book has undoubtedly suffered through the proper desire to avoid additions and alterations; it seems unfortunate that omissions such as a description of the quadrato, or mention of such an interesting genus as *Lanthanotus*, should not have been noted, and that some attempt should not have been made to secure uniformity of treatment in the second portion of the book. Here it frequently appears as if recent genera are only known as fossils! Most regrettable of all, though, is the absence of an index. Concerning the scheme of classification and the interpretation of facts there will, of course, be differences of opinion; but the views expressed in this book are the considered and final opinions of a great palæontologist to whom the volume makes a fitting memorial.

*Spitzbergen Papers.* Vol. I. Published by the  
Oxford University Press.

In the present volume a large number of papers, connected with the various expeditions which visited Spitzbergen from 1921-1924, have been collected together.

The Spitzbergen Expeditions originated in the idea of an ornithological visit to that country, but this idea rapidly enlarged until the 1921 expedition finally impressed experts on Ornithology, Botany, Zoology, Geology, etc. So successful was this expedition, under the leadership of the Rev. F. C. R. Jourdain, that further expeditions were organized in each of the following three years. The results of these expeditions have appeared in various journals and papers, not only in England, but in France and America. Those in authority soon came to the conclusion that, both for

purposes of study and for reference, it was advisable that the whole of these papers should be brought together in one volume; hence the work now under review.

The total number of papers collected is thirty-three, written by Messrs. R. A. Fraser, J. S. Huxley, John Walton, Rev. F. C. R. Jourdain, and the other experts, each on their own particular division of work. Altogether we have twenty-eight authors engaged on the thirty-three papers contained in the volume. No attempt has been made to print the various papers on the same-sized pages. The consequence is, we have an extraordinary mixture and perhaps a little difficulty in handling the book as a whole, so we suggest that, if future volumes are contemplated, it would be advisable to obtain the reprints on pages the same size as the largest contained in the volume. There can be no doubt that the collection of the papers into one whole will be a great boon to all those who have taken an interest in the Spitzbergen Expeditions. The general get up of the book is admirable, the paper and letterpress excellent, and the photographs, although reprints, sharp and well defined.

We congratulate the Clarendon Press on the production of so useful and well got up a volume, and anticipate with pleasure others to come.

## MISCELLANEOUS.

*Dates of Publication of Early Catalogues of Natural History issued by the British Museum.* By C. DAVIES SHERBORN.

(Information supplied from the Records by permission of the Trustees of the British Museum.)

THE old "Gray" Catalogues have been for many years the chief source of information on various branches of systematic zoology, and many difficulties have arisen in questions of priority by reason of imperfect knowledge of the date of their publication. At this distance of time it is impossible to recover the exact day on which they were offered for public sale, and we must be contented to recover the exact day on which they were "laid upon the table" of the Trustees, a preliminary to the issue to the public. I am, therefore, indebted to the Trustees for the information subjoined, which includes all those volumes consulted by me for the 'Index Animalium' (1801-1850), and I hope that later on it may be possible to provide similar information for later publications of the Trustees of the British Museum, so that we may clear up doubtful cases of priority.

## BRITISH MUSEUM.

- Syst. Catal. Indig. Mamm. Birds . . . By W. E. Leach. 4to. 1816. [No trace in Minutes.]
- Synoptical Contents. The 42nd ed., 1840; the 42nd ed. (with additional pages 12\*, 13\*, 160\*-164\*, 1841. [No trace in Minutes.]
- List of Spec. of Mamm. in Coll. B.M. By J. E. Gray, 1843. [13 May, 1843.]
- List of Myriapoda . . . By Newport, 1844. [8 June, 1844.]
- Catal. of Tortoises, Croc., etc. . . . By J. E. Gray, 1844. [27 July, 1844.]
- List Lepidopt. Ins. . . . By E. Doubleday, 1845-48. [I. 21 Dec. 1844; II. 17 Apr. 1847; III. 5 Aug. 1848.]
- List Birds . . . By G. R. Gray, 1844-48. [I. 22 June, 1844; ed. 2, 11 Mar. 1848; II. 11 Nov. 1848; III. 12 Oct. 1844.]
- List Lizards . . . By J. E. Gray, 1845. [28 June, 1845.]
- Catal. Spec. and Drawings Mamm. and Birds of Nepal and Thibet presented by B. H. Hodgson. By G. R. Gray, 1846. [9 Jan. 1847.]
- List Hymenopt. . . . By F. Walker, 1846-48. [I. 4 Apr. 1846; II. 13 May, 1848.]
- List Crustacea . . . By A. White, 1847. [17 Apr. 1847.]
- List Osteological Spec. . . . By Gray and Gray, 1847. [17 Apr. 1847.]
- Nomencl. Coleopt. . . . By A. White, 1847-49. [I. 3 July, 1847; II. 18 Dec. 1847; III. 8 July, 1848; IV. 21 July, 1849.]
- List Dipt. Ins. . . . By F. Walker, 1848, 1849. [I. 9 Dec. 1848; II. 21 Apr. 1849; III. 30 June, 1849; IV. 8 Dec. 1849.]
- List Brit. Anim. . . . 5 parts, 1848-50. [I. Centronia, by J. E. Gray, 31 Aug. 1848; II. Sponges, by J. E. Gray, 11 Nov. 1848; III. Birds, by G. R. Gray, 6 July, 1850; IV. Crust. by A. White, 13 July, 1850; V. Lepidopt., by J. F. Stephens, 14 Dec. 1850.]
- Catal. Moll. . . . Pt. I. Ceph. Antep., by J. E. Gray, 1849. [30 June, 1849.] Pt. II. Pteropoda, 1850. [9 Feb. 1850.]
- Catal. Snakes . . . By J. E. Gray, 1849. [27 Oct. 1849.]
- Catal. Spec. of Mamm. . . . By J. E. Gray, 1850. [I. 6 July, 1850; II. 14 Dec. 1850.]
- Catal. Amphib. . . . By J. E. Gray, 1850. [I. (does not exist); II. 9 Nov. 1850.]
- Catal. Bivalve Moll. . . . By J. E. Gray, 1850. [I. 6 July, 1850.]
- Nomencl. Moll. . . . By W. Baird, 1850. [12 June, 1850.]
- List Homopt. Ins. . . . By F. Walker, 1850. [9 Nov. 1850.]

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XXXIX.—*Some Orthoptera from the Russian Far East.*  
By B. P. UVAROV.

THE fauna of Orthoptera of the Russian Far East remains practically unexplored, while even the scanty records existing offer ample evidence of its exceptional interest, particularly from the zoogeographical point of view. I was, therefore, very pleased to get an opportunity of working out a small collection made by Dr. V. M. Englehardt in several localities near Vladivostok, and received through the kind assistance of my friend Professor V. E. Boldyrev and Miss E. F. Miram, to whom all my thanks are due.

My work was done in the British Museum (Natural History), where paratypes of some of the new species are preserved, while the types will be deposited in the Zoological Museum of the Russian Academy of Sciences, Petrograd.

Species not yet recorded from Russia are marked in the following list with an asterisk. Their number is surprisingly large: amongst thirteen species of Tettigoniidæ six are new to the Russian fauna, including four species new to science, while not more than a single species of Gryllidæ out of six recorded was known from Russia before; even amongst the better-known Acrididæ there is one species new to the fauna.



## Mantidæ.

*Mantis religiosa* (L.).

Tatyanovka, distr. Spassky, prov. Primorskaya, 20. viii. 1924.

Known from China and Korea, but not yet recorded from the Russian Far East.

## Tettigoniidæ.

*Phaneroptera falcata* (Scop.).

Russian Island, 19. vii. 1924, 1 ♂, 2 ♀ ♀.

\**Kuwayamæa sapporensis*, Mats. et Shir.

1908. *Kuwayamæa sapporensis*, Matsumura & Shiraki, Journ. Coll. Agric., Tohoku Imp. Univ. iii. pt. i. p. 8, pl. ii. fig. xi.

1913. *Kuwayamæa yezoensis*, Matsumura, Thousand Insects of Japan, Additamenta, i. 1913, p. 80, pl. v. fig. 1.

District Spassky, prov. Primorskaya, 17. viii. 1924, 1 ♀.

The genus and species have been described by Matsumura and Shiraki from Sapporo and Josankei, in Yezo (Hokkaido), and later on Matsumura altered (or simply misquoted) the name to *yezoensis*. The Yezo Island of Japan being just opposite Vladivostok, it is only natural that the insect should occur on the mainland. In the British Museum there is also a male from the Quelpart Island, off Korea.

*Atlanticus brunneri* (Pylnov). (Figs. 1-3.)

1914. *Amuria brunneri*, Pylnov, Revue Russe d'Entom. xiv. pp. 100-110, figs. 3-5.

1924. *Atlanticus brunneri*, Uvarov, Trans. Entom. Soc. London [1923], p. 511.

Russian Island, 1 ♂, 2 ♀ ♀, 1 larva ♀.

It is only thanks to the valuable assistance of my friend B. S. Vinogradov that I was able to identify this species. He has examined the types of *A. brunneri* for me, and found that the original description lacks some important details, while the figures accompanying it are only diagrammatic and very inaccurate. A comparison of sketches made by Vinogradov from the types by the aid of a camera-lucida (figs. 1-3) with the figures given by Pylnov makes the differences quite clear. Thus, the male cerci are armed not with an obtuse and almost straight tooth, as figured by Pylnov, but with a pointed and strongly recurved hook.

The shape of cerci in the male from the Russian Island agrees quite well with the fig. 1, but, of course, not with Pylnov's figure. It must be mentioned only that in the specimen before me the hook is placed at the end of the basal third of cercus and not at its base, as it appears in fig. 1, simply because the basal part of the cercus in type is covered by the anal tergite almost up to the hook. The male subgenital plate is figured by Pylnov also very incorrectly; it is in the type (fig. 2) broader basally and distinctly narrowed behind, while the apical margin is rectangularly, not acutely, excised. In the specimen from the Russian Island the plate is still more distinctly narrowed behind than in the type, in which this structure is obviously deformed. The male anal tergite (fig. 3) is in the

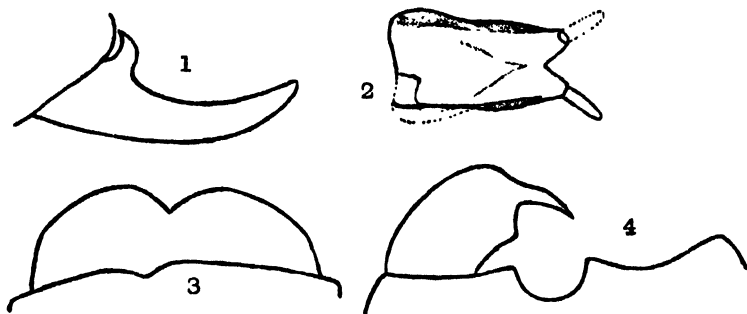


Fig. 1.—*Atlanticus brunneri*, Pylnov, ♂, type, left cercus.

Fig. 2.—Ditto, subgenital plate.

Fig. 3.—Ditto, anal tergite.

Fig. 4.—*Atlanticus ussuriensis*, sp. n., ♂ type, anal tergite and right cercus.

type much more deeply excised behind than in Pylnov's figure; in my specimen the emargination is still deeper and narrower, almost slit-like, but I cannot attach any importance to this character, which usually depends on the preservation of specimens and is also very variable in other species of the genus (see Røhn and Hebard, Trans. Amer. Ent. Soc. xlii. 1916, p. 38).

The female subgenital plate in the type bears a faint raised median line, while in the females from the Russian Island it is provided with a feeble linear sulcus; as the types are badly preserved, I do not think this is an actual difference.

In all other respects my specimens do not differ from the

types, being only slightly larger, as follows:—Total length, ♂ 29, ♀ 31; pronotum, ♂ 10, ♀ 10.5; hind femur, ♂ 26, ♀ 28; ovipositor, ♀ 24 mm.

*A. brunneri* is near *A. sinensis*, Uv. (described in the Trans. Ent. Soc. London, 1924, p. 512), which differs from it in the hook on the cerci being practically in the middle, in the male subgenital plate not emarginated apically, and in the ovipositor more straight and less pointed apically. The third Asiatic species, *A. palpalis*, R. & H., differs strongly from both species discussed by its much larger size and by the quite different genitalia.

*\*Atlanticus ussuriensis*, sp. n. (Fig. 4.)

Similar in size and general appearance to *A. sinensis*, Uv., but differing from it in the genitalia of both sexes and in more developed elytra.

♂. Face somewhat reclinate. Fastigium of vertex seen from above narrower than the horizontal diameter of an eye, constricted at the base; seen from the front it is narrowed apically, the apex being less than half as broad as the first antennal joint; upper surface flattened, with a distinct narrow median sulcus not reaching the apex. Maxillary palpi with the last joint incrassate apically, about half again as long as the subapical joint. Occiput very feebly convex.

Pronotum relatively short. Disc convex in prozona and flat in metazona, constricted at its anterior third, the width here being half the width of the hind margin, which is very feebly rounded, practically truncate. First sulcus well distinct; V-shaped sulcus very distinct; hind sulcus broad and very shallow, practically straight. Median keel absent. Lateral keels entirely absent between the front margin and the V-shaped sulcus; behind the latter they are distinct, but very broadly rounded. Lateral lobes sloping under an obtuse angle to the disc, though the angle itself is present only behind, being completely rounded in the prozona; their lower margin, including the angles, broadly rounded, the hind angle not at all projecting downwards; hind margin without the humeral sinus. Prosternal spines short, conical.

Elytra half again as long as pronotum, not at all covered by it.

Abdomen without any carinae; tergites truncate behind. Last tergite truncate behind, with two short, obtusely triangular lobes in the middle, separated by a small emargination. Cerci thick and short, scarcely narrowed behind; the apex attenuated into a pointed hook strongly incurved;

on the inner margin there is a small preapical tubercle. Subgenital plate fairly broad; hind margin very shallowly and broadly excised; styli longer than the apical width.

General coloration castaneous-brown. Antennæ blackish brown, with narrow paler wings. First two antennal joints, apex and sides of fastigium and postocular fasciæ are black. Face pale testaceous, with indefinite brownish markings. Occiput brown, marmorated with castaneous. Pronotal disc castaneous, darker anteriorly and posteriorly, with the V-shaped sulcus and a pair of streaks in front of it black; lateral lobes shining black, but marmorated with brown, in more than upper half, yellowish in the rest. Pleuræ black, with a broad yellowish horizontal fascia along the middle. Elytra castaneous; speculum blackish; veins surrounding it and the hind radial vein, as well as the field adjoining the latter, black. Anterior and middle legs conspicuously marmorated and spotted with black. Hind femora with the inner side shining black to beyond the middle; outer side black to the same extent, but with a large elongate yellowish spot in the basal half above and a narrow yellowish stripe along the lower margin, not touching, however, the latter; lower area old ivory-white in the basal third, black in the middle, testaceous in the rest; spines black. Abdomen black laterally, above blackish castaneous, with reddish-brown sublateral stripes, clothed above with yellowish hairs.

♀. Subgenital plate transverse, with a fine median carinula (perhaps due to contraction from drying); hind margin broadly and not deeply angulate-excised in the middle, the lobes broadly rounded. Ovipositor distinctly longer than the body, regularly and not strongly decurved.

Elytra as long as pronotum, quite free.

Total length, ♂ (type) 24; ♀ (paratype) 25.5; pronotum, ♂ 7, ♀ 8; elytra, ♂ 11, ♀ 8; hind femur, ♂ 23, ♀ 25; ovipositor, ♀, 27.5 mm.

Described from one male and three females collected by Dr. V. Engelhardt in the meadows and marshes in the district Spassky, prov. Primorskaya, 17. viii. 1924.

This fine new species is remarkable for its pronotum scarcely produced behind and not covering the elytra, which are perfectly free and considerably longer than in any known species of the genus.

With the description of this species there are four species of *Atlanticus* known from Eastern Asia, while nine more are peculiar to North America. This remarkable distribution of species of the genus is still more interesting because its American representatives are all restricted to the south-

western corner of the United States, only two of them reaching the upper course of Mississippi, and one only going as far westwards as Arkansas. There is, thus, a very broad gap between the two areas where representatives of the genus occur, and it would be difficult at present to offer an exhaustive explanation of this case. The only suggestion which occurs to me is that the genus had a continuous area of distribution in pre-Glacial times, when its representatives populated the whole of North America and Eastern Asia, but the advent of glacial conditions drove them southwards, thus splitting up the genus into two geographically separated groups. Adopting this view, we are forced to conclude that the post-Glacial conditions in that part of the world never reached the same level as before the glaciation, thus preventing a subsequent northward migration of the respective species of *Atlanticus*.

It is this isolation of two groups of species which must be considered responsible for some general differences between the American and the Asiatic groups. The four species of that latter group all possess more developed elytra and less elongated behind pronotum than the American ones; apart from that, the male cerci in all of them are more or less, sometimes very strongly, incurved. These characters are, however, not sufficient to be regarded as generic, or even subgeneric.

### *Key to Asiatic Species of Atlanticus.*

- 1 (6). Pronotum longer than anterior femora. Elytra of the ♂ covered by pronotum at least up to the base of speculum; elytra of the ♀ entirely, or almost, hidden under pronotum.
- 2 (5). Last joint of maxillary palpi less than twice as long as the preceding joint.  
 ♂. Elytra distinctly shorter than pronotum, not reaching the middle of abdomen. Last tergite with the lobes broadly rounded. Cerci with the apex feebly incurved and not pointed.  
 ♀. Ovipositor distinctly recurved.
- 3 (4). Smaller; greyish.  
 ♂. Hook of the cerci in their middle. Subgenital plate not emarginated apically.  
 ♀. Ovipositor feebly recurved, less acute apically. [Ussuri region] ..... *A. sinensis*, Uv.
- 4 (3). Larger; chocolate-brown.  
 ♂. Hook of the cerci before their middle. Subgenital plate triangularly excised behind.

- ♀. Ovipositor strongly recurved, more acute apically. [Ussuri region; Island Russian] ..... *A. brunneri* (Pyl.).
- 5 (2). Last joint of maxillary palpi twice as long as the preceding joint. Size large.  
♂. Elytra large, extending beyond the middle of abdomen. Last tergite with the lobes triangular. Cerci with the apex strongly incurved and pointed.
- ♀. Ovipositor practically straight. [Fukien province, China] ..... *A. palpalis*, R. & H.
- 6 (1). Pronotum shorter than anterior femora. Elytra in both sexes free, not shorter than pronotum.  
♂. Last tergite truncate, with very short obtuse lobes. Cerci short, thick, with the apex incurved and pointed, and with a preapical tubercle. Subgenital plate rounded-emarginate.
- ♀. Ovipositor distinctly decurved. [Ussuri region] ..... *A. ussuriensis*, Uv.

*Gampsocleis obscura* (Wal.).

## Russian Island.

The species was described by Walker from Corea, and again by Adelung, under the name *G. christinici*, from the Ussuri-land; I have recorded it from Tchifu and Kupekau in China, and from Baranovsky on Amur (Trans. Ent. Soc. London, 1923 [1924], p. 520).

*Gampsocleis ussuriensis*, Ad.

Russian Island; Tatyankovka, distr. Spassky, prov. Primorskaya, 12. viii. 1924.

For the synonymy and distribution of this species, see my paper quoted above (*l. c.* p. 523).

*\*Metrioptera bonneti* (Bol.). (Figs. 5 & 6.)

Russian Island; Okeanskaya, prov. Primorskaya, 15. vii. 1924.

This species has been very briefly described by I. Bolivar from the Yezo Island of Japan, and its exact determination proved to be possible for me only after a comparison of my specimens with the types, ♂ and ♀, kindly sent to me by my friend Professor Candido Bolivar.

The following additional characters should be included in the specific description:—

Disc of pronotum sometimes apple-green, slightly convex

in front, flattened but not concave behind; median keel slightly developed in metazona only; lateral keels scarcely perceptible behind, quite absent in front. ♂. Last tergite deeply and narrowly incised, with the lobes narrow, acuminate, crossing or at least touching each other. Cerci with a subbasal tooth. ♀. Sixth sternite with a shallow, straight, transverse impression parallel to its hind margin; last sternite with a low thick transverse ridge, followed by a shallow depression all along the hind margin; subgenital plate thick, convex, narrowly but deeply sulcate along the middle, with a deep oval emargination; its lobes pointed,

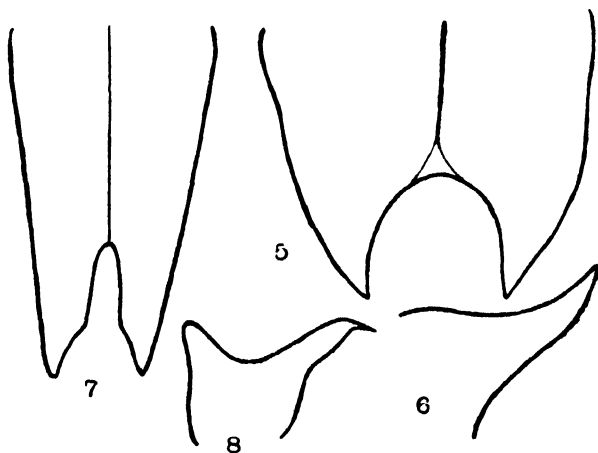


Fig. 5.—*Metrioptera bonneti*, Bol., ♀, type, subgenital plate.

Fig. 6.—Ibid., one lobe of the plate, side view.

Fig. 7.—*Metrioptera engelhardti*, sp. n., ♀, type, subgenital plate.

Fig. 8.—*Metrioptera ussuriiana*, sp. n., ♂, type, right cercus.

somewhat recurved when viewed in profile. (Description of genitalia drawn from types.)

The specimens before me differ from the types in slightly smaller size and in the somewhat shorter and more obtuse lobes of the female subgenital plate. I do not attach, however, any taxonomic importance to these differences, since a series of specimens from Japan and from the Tsushima Island, received by me from the Berlin Museum, presents some individual variations in those respects.

[This is another Yezo species found on the mainland (see above, under *Kuwayamea sapporensis*).

*\*Metrioptera engelhardti*, sp. n. (Fig. 7.)

♀. Similar in size and in habitus to *M. albopunctata*, Goeze (= *grisea*, F.). Head small, pronotum covering it almost to the eyes. Fastigio-frontal suture scarcely longer than the width of the first antennal joint. Pronotum relatively shorter and broader than in *M. albopunctata*; its base scarcely narrowed anteriorly, practically flat and smooth in prozona, very slightly impressed and distinctly punctured in metazona; hind margin very broadly rounded; lateral keels very much rounded; median keel distinct in metazona, faintly indicated in prozona; lateral lobes less high than in *M. albopunctata*, with the anterior margin more oblique. Prosternum unarmed. Mesosternal lobes much longer than at the base, broad, their apical angles about 30°. Metasternal lobes not longer than broad, their apical angles straight. Elytra extending well beyond the hind knees. Hind femora relatively shorter than in *M. albopunctata* and more suddenly attenuate behind the middle, coarsely punctured above. Last sternites without any peculiar structures. Subgenital plate unusually narrow and long, covering the basal fourth of ovipositor; its lower surface finely keeled along the middle, slightly impressed sideways; apex narrow, deeply and very acutely excised; apical lobes lying very closely to sides of ovipositor, with the inner margins rounded, the outer margins straight, and the apical angles slightly less than 90°. Ovipositor like that of *M. albopunctata*, but more strongly narrowed in the apical half.

Coloration castaneous, shiny. Head with shining black postocular fasciæ, and an indefinite blackish median fascia on the occiput, including a fine pale line. Mandibulæ black, with brown apices. Pronotal lateral lobes shiny blackish-castaneous, quite black above, very narrowly and not sharply marginated with pale posteriorly and (less distinctly) anteriorly. Elytra smoky, with indefinite castaneous spots. Wings distinctly infumate towards the apices. All femora black above, the hind ones black externally as well, getting paler in the attenuate part, but the knees are blackened.

Length of body 17; pronotum 6; elytra 27.5; hind femur 19; ovipositor 10 mm.

Another female (paratype) is of a pale coloration, with the black colour less spread, but otherwise not distinct from the type.

Named after Mr. V. M. Engelhardt, ardent naturalist and painstaking observer, who collected it.



Although I compare this fine new species with *M. albopunctata*, Goeze (= *grisea*, F.), I do so only in order to make clear its chief characters, but not to indicate the relationship. Indeed, I think that *M. engelhardti* is nearer to the group *brachyptera-roeseli* than to *M. albopunctata*; this question, however, cannot be settled until the male is known.

The new species is very easily recognisable by the highly peculiar shape of the female subgenital plate, by the pronotum not narrowed anteriorly, and by its coloration.

*\*Metrioptera ussuriانا, sp. n. (Fig. 8.)*

♂. Similar in general appearance to *M. roeseli* (Hag.).

Pronotum with the disc distinctly widened behind; metazona impressed, obsoletely punctured, with a distinct median carina, very broadly rounded, practically truncate, behind. Lateral lobes distinctly longer than deep, with the hind margin very long, strongly obliquely ascending, and perfectly straight.

Elytra broad, inflated, reaching beyond the middle of abdomen, widened towards the apex which is very broadly rounded. Speculum large, angulate, without veinlets.

Last abdominal tergite with a pair of large, subtriangular, divergent lobes. Cerci short, but with the basal portion very thick; apex short conical; armed inwardly with a very long, slightly curved, postbasal spine, attenuate apically, but with the immediate apex incrassate. Subgenital plate long, tectiform, with the median carina sharp and two thick parallel lateral carinae; hind margin deeply and acutely excised; styli long.

General coloration reddish castaneous. Head paler; apex of fastigium castaneous; postocular fasciae broad, blackish brown, with a narrow pale median line. Lateral lobes of pronotum chocolate-brown, shining, with the lower and hind margin not broadly yellowish. Elytra semitransparent, brownish infumate, with few of the veins partly blackish; apical part with indistinct small darkish spots. Hind femora brownish stramineous, outer area with black longitudinal stripe, emitting short transverse branches on both its sides.

Total length 17; pronotum 5.5; elytra 9; hind femur 16 mm.

A single male from the district Spassky, prov. Primorskaya, 12. vii. 1924.

As will be seen from the description, the resemblance of

this species to *M. roeselii* is only superficial, there being striking differences in the shape of pronotum, of elytra, and, particularly, of external genitalia, which make the new species very easily recognizable.

*Conocephalus chinensis* (Redt.).

1891. *Xiphidium chinense*, Redtenbacher, Verh. zool.-bot. Ges. Wien, xli. p. 509.

Okeanskaya, 15. vii. 1924, 4 ♂♂, 4 ♀♀; Isl. Russky, 17. vii. 1924, 1 ♀.

The species has been described from "Amur" in the male sex only. Matsumura and Shiraki recorded it from Japan and published a description of both sexes†. *C. chinense* is very similar to *C. fuscus* (F.), but differs from it strongly in the narrow and parallel-sided fastigium of vertex, in the rounded-excised subgenital plate of the male, and in the ovipositor equalling only to about two-thirds of the hind femur.

Another larger species of *Conocephalus*, with a long ovipositor, is represented in the collection by a single female, which I hesitate to identify without the male.

*Homorocoryphus nitidulus* (Scop.).

Russian Island; Okeanskaya, prov. Primorskaya, 13. vii. 1924.

The four specimens before me differ from the typical (i. e., South European) form by the relatively short elytra, which in the females extend only a little beyond the middle of the ovipositor. A female from the Russian Island is also remarkable for the presence of a row of four to six black dots just in front of the radial vein and parallel to it; about ten smaller dots are scattered in the apical part of elytra; general coloration of the female is green. A male from the Russian Island is yellowish brown, with brown dots all over elytra, and a pair from Okeanskaya are plain green in colour.

*Diestrammena unicolor*, Br. W.

Russian Island.

The specimens (1 ♂, 2 ♀♀) have the pronotum shining black, with a fine median line, two small spots on the anterior margin, and two large but indefinite spots near the posterior

† Journ. College Agric., Tohoku Imp. Univ. iii. pt. 1, 1908, p. 53.

margin reddish brown, as is the whole body. In the original description coloration is stated to be "fusco-castanea," apparently without pattern, but since this cannot be a constant character I do not hesitate in my identification, particularly because Vladivostok is the typical locality for this species.

Brunner recorded this species also from Peking and from the caves in Tenasserim, but Chopard has shown (Bull. Soc. Ent. France, 1921, p. 210) that the Tenasserim record should apply to *D. feai*, Chop.

*\*Tachycines boldyrevi, sp. n.*

♀. A very uniformly coloured species with the hind femora only very feebly spined below, which makes it intermediate in this respect between the subgenera *Tachycines*, s. str., and *Gymneta*, Ad.

Fastigium of vertex quite depressed, angulately incised. Pronotum distinctly convex in profile, narrowed in front; front margin convex; hind margin very slightly convex. Lateral lobes of mesonotum depressed, broadly rounded-truncate behind. Front coxæ with a short, but acute, conical tooth; front femora with a short, mobile, external apical spine; front tibiae with two pairs of spines on the lower margin, and with three apical spurs and a short median spinule. Middle coxæ unarmed; middle femora with two apical mobile spines, the hind one being longer; middle tibiae with four spines below, four spurs, and a median apical spinule. Hind femora with four minute spinules below, without the genicular spine; hind tibiae with about 85 densely-placed spines, very indistinctly separated into small series of two to three spines each, the 60th (approximately) spine, counting from the base, is much larger than others; apex of tibiae with two spinules above, two slightly longer ones below, one short outer spur, and two inner spurs, the upper one of which is slightly shorter than metatarsus. Last abdominal tergite trapezoidal, with the sides incurved and the apex truncate. Supra-anal plate slightly longer than broad, slightly narrowed to the elliptical apex. Subgenital plate longer than broad, narrowly parabolic, feebly convex. Ovipositor with both upper and lower margin slightly curved; apex distinctly recurved; upper valvæ strongly narrowed apically, but with the immediate apices blunt; lower valvæ with the apices moderately narrow, but acute, with about eight scarcely perceptible subapical incisions below.

Coloration uniformly dull brown, legs paler, without any markings, tarsi and palpi whitish.

Length of body 15; pronotum 5.5; front femur 10; front tibia 10.5; middle femur 10; middle tibia 9; hind femur 18; hind tibia 19; ovipositor 13 mm.

Described from one adult female and two female larvæ.

I named this species after my friend Professor V. F. Boldyrev, whose brilliant works on bionomics of Orthoptera are well known and remarkable for the rare combination of scientific accuracy and thoroughness with a vivid, sometimes almost poetical, narrative.

*T. boldyrevi* differs from all known species already by its very uniform coloration, reminding one of *Dolichopoda*. It resembles in this respect *T. racovitzi*, Chop., from caves near Tonkin, but that latter species differs from it by the female subgenital plate dentate basally, by the hind legs being longer, and by some details in the armature of legs.

In the armature of hind femora *T. boldyrevi* presents a connecting-link between *Tachycines*, Ad., and *Gymneta*, Ad., because the femoral spinules in my species are smaller and less in number than in *Tachycines*, but still not absent altogether as it should be in *Gymneta*; this confirms Chopard's conclusion (Bull. Soc. Ent. France, 1916, p. 158) that the degree of development of the spinules cannot be regarded as more than a subgeneric character.

### Gryllidæ.

#### *\*Pteronemobius csikii* (Bol.).

Russian Island, 15. vii. 1924.

I. Bolivar described this species after a single female, from Daba, near Kalgan, in Northern China, and I identified my specimens by comparing them with the type, which has been very kindly sent me for study by Prof. Csiki, of the Hungarian National Museum.

Since Bolivar's description is somewhat short and based on the female sex only, I think it useful to give here a re-description of the species from fresh specimens of both sexes, as follows:—

A very lightly coloured species, strikingly marked with brown and black.

♂. Head somewhat depressed, transverse, broader than pronotum in front. Fastigium of vertex slightly narrower than the first antennal joint. Pronotum distinctly narrowed in front; front margin slightly concave; hind margin more

distinctly convex ; lateral lobes nearly twice as long as broad, broadly and shallowly impressed in the hind half ; their front angle obtuse, broadly rounded ; lower margin very distinctly sinuate ; hind angle broadly rounded-truncate. Elytra just reaching apex of abdomen, broad ; speculum large, oblique, with two additional cells at the hind angle ; lateral field broad, with four parallel veins and some sparse feeble perpendicular veinlets in the two upper areas. Wings undeveloped. Hind tibiæ armed with four spines on each side, including the subapical spines ; the first spine of the inner series short, inflated basally, then strongly attenuate and somewhat bent ; subapical spine of the same series shorter and stouter than the preceding one, with the apex blunt ; upper inner spur equal to about three-quarters of metatarsus ; lower inner spur slightly longer than half of metatarsus ; lower outer spur somewhat shorter than half of metatarsus, and upper outer spur about one-third of metatarsus. Metatarsus not denticulate. Subgenital plate small, obtuse, with the apex emarginate.

Of a pale sandy colour. Antennæ with the first joint of the same colour, second slightly brownish apically, the rest broken off. Maxillary palpi pale testaceous with dark fasciæ ; apical joint blackish, with a pale median fascia. Face very pale, shining ; antennal foveolæ margined with brownish ; a pair of brown spots, and another, of smaller size, below them. Head above pale ochraceous, with faintest traces of longitudinal fasciæ on the occiput and an indistinct brownish spot on vertex, where there are also some thick black bristles, the rest of the head being clothed with not dense, short, brown hairs and scattered bristles. Pronotum of a slightly paler shade than head above, in scattered brown dots and spots, clothed with not dense yellowish hairs and bearing some black bristles ; anterior border pale with two rows of black bristles, those of the hind row arising from brown dots ; two transverse subtriangular brown spots adjoining the front border ; a pale line along the middle, indistinctly margined with brown ; two fairly large brown spots, more distant than those of the front border, at the hind border, their interspace slightly reddish ; hind border pale, with a few brown dots and black bristles ; later lobes quite pale, with a large spot at the front margin above, two small spots behind, two to three dots in the middle, and more than hind half of the lower margin, brown. Pleuræ black, with pale stripes. Abdomen below clothed with dense yellowish hairs, sides blackish brown, annulated with pale ; last sternite and subgenital plate black in the middle.

Cerci pale, with the base and a submedian ring brownish black. Legs ivory-white, with sharply-defined black rings and dots, bearing black bristles. Hind femora dirty ivory-white; outer face with a small spot near the base above, a fairly large spot before the middle in the upper half, an irregular dentate fascia beyond the middle, and a narrow straight pre-genicular fascia black; knee blackish brown. Hind tibiae with the base, apex, two rings, and bases of all spines black. Apex of metatarsus black. Elytra faintly infumate; lateral field brownish above, with the veins whitish.

♀ (paratype). Black and brown pattern more developed than in the type; spots on the face confluent, forming almost a transverse fascia below antennae; lateral lobes of pronotum with an almost continuous black fascia along the upper margin; sub-basal and pre-median spots of the hind femora confluent. Elytra with four complete veins, the innermost bifurcate near the base and a short one near the inner margin; lateral field as in the male. Wings well developed, partly infumate. Subgenital plate obtuse, rounded, brown in the middle. Ovipositor slightly shorter than hind femur, practically straight, its upper margin very distinctly denticulate in the apical part.

Length of body, ♂ 6, ♀ 7; pronotum, ♂ 1.5, ♀ 2; elytra, ♂ 4.5, ♀ 5; wings, ♀, 11; hind femur, ♂ 5, ♀ 5.5; ovipositor, ♀, 5 mm.

The species obviously occurs in both brachypterous and macropterous condition in the same place, as both males before me are wingless and the female is provided with wings. According to a communication from Dr. Englehardt, the insect is quite common on the sandy beaches near Vladivostok, and its coloration is in complete harmony with its surroundings. Three other species of the same genus, occurring actually together with *Pt. csikii* (see below), are, however, of much darker coloration.

Chopard recently recorded this species from Ceylon (Ann. & Mag. Nat. Hist. ser. 9, xv. 1925, p. 507), so that it must occur all over Southern Asia. The Ceylonese specimens differ from the typical ones in somewhat smaller size and in the darker coloration, with the black markings more developed.

*\*Pteronemobius fascipes* (Walk.).

1869. *Eneoptera fascipes*, Walker, Cat. Derm. Salt. Brit. Mus. i. p. 67.  
1871. *Eneoptera alboatra*, Walker, l. c. v., Suppl. p. 11 (*syn. nov.*).

1877. *Nemobius histrio*, Saussure, Mém. Soc. Phys. Genève, xxv. p. 95.  
 1904. *Nemobius nigrofasciatus*, Matsumura, Thousand Ins. Japan, i.  
 p. 138, pl. vi, fig. 14 (*syn. nov.*).  
 1911. *Nemobius nigrofasciatus*, Shiraki, Monogr. Gryll. Formosa, p. 77.

Russian Island, 15. vii. 1924.

Chopard recently (Ann. & Mag. Nat. Hist. ser. 9, xv. 1925, p. 507) established synonymy of *N. histrio* with *fascipes* of Walker, and I am able to add two more synonyms, viz. *albeatra*, Walk., of which I studied the type, and *nigrofasciatus*, Mats., easily recognizable from the re-description given by Shiraki.

The species seems at first sight to represent merely a dark form of *Pt. csikii*, but it differs from it by the distinctly shorter ovipositor and by different disposition of black markings. Particularly noticeable are its entirely black lateral pronotal lobes, which are only spotted with black in *Pt. csikii*; another good difference is in the coloration of maxillary palpi, which are black, with two last joints pure white, the apical one black-tipped, while in *Pt. csikii* the palpi are not at all strikingly coloured.

Only brachypterous form is in the collection.

The distribution of this species also covers a very wide area—from Northern India and Ceylon to Java, Singapore, Formosa, and Japan, while Dr. Engelhardt's collection shows that it is quite common near Vladivostok. Specimens from Ceylon and India are smaller than ours, but otherwise not different from them.

*\*Pteronemobius taprobanensis* (Walk.).

1869. *Trigonidium taprobanense*, Walker, Cat. Derm. Salt. Brit. Mus.  
 i. p. 102.  
 1871. *Eneoptera lateralis*, Walker, l. c. v., Suppl. p. 11.  
 1877. *Nemobius infernalis*, Saussure, Mém. Soc. Phys. Genève, xxv.  
 p. 83.  
 1877. *Nemobius javanus*, Saussure, l. c. p. 85.

Russian Island, 15. vii. 1924.

The above synonymy has been established by Chopard (l. c. p. 507), *infernalis* being only a brachypterous form of the species.

Specimens from the Russian Island are, as in other species, larger and also of much darker general coloration than in the specimens from Ceylon and India. Apart from that the females possess a relatively longer ovipositor, but I hesitate to regard these characters as subspecific until more is known about their being sufficiently constant.

*Nemobius mikado*, Shiraki, seems to be very similar to this

species, agreeing with it in all essential details of coloration, but differing (as far as it may be concluded from Shiraki's description and figures) by the pronotum scarcely narrowed anteriorly and the hind tibiae armed with 3:3 spines.

*Pt. taprobanensis* is easily separated from the preceding two species by the hind femora not fasciated with black, and from the next one by the black last joint of maxillary palpi, apart from the armature of the hind tibiae.

The species is known at present from India, Ceylon, Burma, Java, and Vladivostok.

Both brachypterous and macropterous forms are in the collection.

*\*Pteronemobius nitidus* (Bol.).

1901. *Nemobius nitidus*, I. Bolivar, Zichy, Dritte Asiat. Forschungsreise, Zool. Ergebn. ii. p. 242.

1911. *Nemobius yezoensis*, Shiraki, Monogr. Gryll. Formosa, p. 85 (*syn. nov.*).

Russian Island, 15. vii. 1924.

Thanks to Prof. Csiki I had an opportunity to compare my specimens with Bolivar's type, a female from Pekin. The description of *N. yezoensis* fits this species in all details, and I feel certain in the above synonymy.

The species is very similar to *P. heydeni*, but the male differs by the last inner spine of hind tibiae much more strongly inflated and curved basally.

Only brachypterous form is represented in the collection.

*\*Gryllus infernalis*, Sauss.

Vladivostok, under stones, 24. vii. 1924, 2 ♂♂, 3 ♀♀. \*

Originally described from Tschifu in China, then recorded by Bolivar from Daba, near Kalgan. New for Russia, though apparently quite common near Vladivostok.

*Gryllotalpa africana* (P. B.).

Tatyanovka, distr. Spassky, prov. Primorskaya, 12. vii. 1924.

Already recorded from the Russian Far East by Adelung (Ann. Mus. Zool. St. Petersb. x. 1906).

**Acrididae.**

*Podismopsis ussuriensis*, Ikon.

Vladivostok; Ivanovka, distr. Nikolsk-Ussuri, prov. Primorskaya.

Ann. & Mag. N. Hist. Ser. 9. Vol. xvii. 19



*Parapleurus alliaceus* (Germ.).

Vladivostok ; Okeanskaya.

*Mecostethus tsherskii*, Ikon.

Tatyanovka, distr. Spassky, prov. Primorskaya.

This species seems to differ from *M. magister* of Rehn (from Japan) only in the absence of a longitudinal carinule on the underside of the male subgenital plate ; since Rehn's only type was from alcohol, it is not impossible that the carinula is due to the shrinking of the plate from drying, in which case *M. tsherskii* (1911) would fall as a synonym of *M. magister* (1902).

The insect is clearly very near to the North American *M. lineatus*. Scudd., differing very strongly from the Palearctic *M. grossus* in the structure of pronotum.

*Arcyptera fusca albogeniculata*, Ik.

Okeanskaya, prov. Primorskaya.

*Stauroderus biguttulus* (L.).

Distr. Nikolsk-Ussuri, prov. Primorskaya.

*Stauroderus aethalinus* (Zub.).

Distr. Nikolsk-Ussuri, prov. Primorskaya.

*\*Oxya adentata*, Willemse.

1911. || *Oxya intricata*, Ivonnikov (nec Stål!), Ann. Mus. Zool. St. Petersb. xvi. p. 257.

1925. *Oxya adentata*, Willemse, Tijdschr. voor Entom. lxxviii. p. 26.

Okeanskaya, near Vladivostok, 13. vii. 1924.

Ivonnikov's mistake in the identification of this insect, which he himself considered doubtful, is perfectly excusable, since even now, when Willemse published his revision of *Oxya*, it is not always easy to identify its species with absolute certainty.

One female before me (and another in the British Museum, presented by Ivonnikov) agree well with the types of *O. adentata*, described from Taipaishan, Shense province of China, while another female quite similar to them in habitus differs in the subgenital plate bearing a pair of submedian spines and two sharp lateral carinae, being similar in that

respect to *O. shanghaiensis*, Will. (l. c. p. 54), but very much smaller. As I am not sure which characters are more constant and important in species of this genus, I hesitate to identify the specimen in question.

*Oxya* is a typically tropical and subtropical genus, and the occurrence of one of its representatives in the Russian Far East is very characteristic for the mixed fauna of that interesting region.

*Prumna primnoa* (F. W.).

Ivanovka, distr. Nikolsk-Ussuri, prov. Primorskaya.

*Podisma parvula*, Ikon.

Ivanovka, distr. Nikolsk-Ussuri, prov. Primorskaya.

*Eirenephilus debilis*, Ikon.

Tatyanovka, distr. Spassky, prov. Primorskaya.

XI.—*The Neotropical Lizards of the Genera Lepidoblepharis, Pseudogonatodes, Lathrogecko, and Sphaerodactylus, with the Description of a new Genus.* By H. W. PARKER, B.A.

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DURING an attempt to name some of the small Central-American "Eublepharids" it was discovered that considerable confusion exists concerning the genera *Lepidoblepharis* (with which has been included *Pseudogonatodes*) and *Lathrogecko*. This very regrettable state of affairs has been brought about to a large extent by the discovery of new and fundamental characters which were not used in the earlier descriptions. Thanks to the courtesy of the Director of the Zoological Museum of the University of Turin, to whom I am indebted for the loan of one of the types of *Lepidoblepharis festae*, Peracca, and of Prof. A. G. Ruthven, who has most generously sent me the unique specimen of *Pseudogonatodes furvus*, Ruthven, it has been possible to examine and compare authentic specimens of almost all the known species of these genera. Thanks are also due to Dr. G. K. Noble for information concerning *Lepidoblepharis microlepis* (Noble).

The most important external character which distinguishes the genera of this series is the composition of the unguis sheath. This character, though mentioned casually and not diagnostically by Peracca in his description of *Lepidoblepharis festæ*, was used by Ruthven in his descriptions of *Pseudogonatodes* and *Lathrogecko*, and its importance from a phylogenetic standpoint has been shown by Noble \*. Comparison of the typical material has, however, shown that the unguis sheath is of the same composition in *Lepidoblepharis*, Peracca, and *Lathrogecko*, Ruthven. The type-specimen of *Pseudogonatodes furvus*, Ruthven, though subsequently referred to *Lepidoblepharis intermedius*, Boulenger †, has the unguis sheath with a different composition from that found in *Lepidoblepharis*, Peracca, but with the same composition as is found in the species described as *Lepidoblepharis barbouri* by Noble. This difference in the unguis sheath is found in combination with other characters which, combined, seem sufficiently important to warrant generic separation. The two genera must accordingly be called:—

#### I. LEPIDOBLEPHARIS, Peracca.

*Lepidoblepharis*, Peracca, Boll. Mus. Torino, xii. 1897, no. 300, p. 1.  
*Lathrogecko*, Ruthven, Occ. Pap. Mus. Zool. Michigan, 1916, no. 21, p. 1, and Misc. Pub. Mus. Zool. Michigan, 1922, no. 8, p. 58; Noble, Proc. Biol. Soc. Washington, xxix. 1916, p. 87, Amer. Mus. Novit. no. 4, 1921 (throughout), and *op. cit.* no. 88, 1923, p. 2; Barbour, Mem. Mus. Comp. Zool. xlvii. no. 3, 1921, pp. 218 & 226.

Digits short or moderate, cylindrical, the distal joints forming an angle with the basal portion, with smooth transverse lamellæ inferiorly; claw retractile vertically into a large compressed sheath composed of six scales—a pair of elongate intero-laterals in contact inferiorly, a pair of elongate supero-laterals, an elongate median dorsal separating the latter, and a small terminal lying in the angle between the tips of the supero-laterals (fig. 1). Head and neck covered with small granular scales; body depressed, tail round; ventral and inferior caudal scales smooth, imbricate; dorsals granular, tubercular, or imbricate. Pupil round; eyelid well developed above. Rostral shield large, with a U-shaped impression on its upper surface. Clavicle moderately dilated, not perforated (fig. 7). Male without femoral pores.

\* Noble, Amer. Mus. Novitates, no. 4 (1921).

† Ruthven, Misc. Pub. Mus. Zool. Michigan, no. 8, 1922, p. 58.

Fig. 1.



Fig. 2.



Fig. 3.

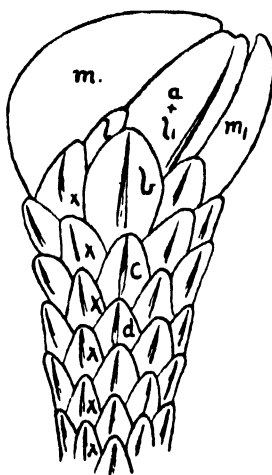


Fig. 4.



Fig. 1.—Fourth left toe of *Lepidoblepharis anthostigma*.

Fig. 2.—Ditto of *Pseudogonatodes barbouri*.

Fig. 3.—Ditto of *Sphaerodactylus microlepis*.

Fig. 4.—Ditto of *Coleodactylus meridionalis*.

*a*, terminal; *b*, median dorsal; *c*, *d*, mid-dorsal row of digits; *m*, outer infero-lateral; *m*<sub>1</sub>, inner infero-lateral; *l*, outer supero-lateral; *l*<sub>1</sub>, inner supero-lateral; *x*, *x*, *x*, second outer row of scales.

The following species are referable to this genus :—

1. *Lepidoblepharis festæ*, Peracca.

*Lepidoblepharis festæ*, Peracca, Boll. Mus. Torino, xii. 1897, no. 300, p. 2.

2. *Lepidoblepharis peraccae*, Boulenger.

*Lepidoblepharis peraccae*, Boulenger, Ann. & Mag. Nat. Hist. (8) i. 1908, p. 111.

3. *Lepidoblepharis intermedius*, Boulenger.

*Lepidoblepharis intermedius*, Boulenger, Proc. Zool. Soc. London, 1914, p. 814, pl. i. fig. 2.

There are two original specimens of this species, both males, but the description was undoubtedly drawn up from the larger only. The smaller does not appear to be specifically distinct from *L. peraccae*. As there are considerable differences between the two, particularly in the number of rows of ventral scales and the coloration, the larger specimen must be regarded as the type of *L. intermedius* and the smaller referred to *L. peraccae*. The latter specimen and another differ from the type of *L. peraccae* in the absence of a dorso-lateral light stripe on the body, but both show distinct traces of it at the base of the tail, where it unites with its fellow.

The British Museum has received an egg and two recently hatched young of *L. intermedius* from the island of Gorgona, Colombia, collected by the Scientific and Expeditionary Research Association. The egg is slightly ovoid, measuring 6.9 × 6.5 mm., and is uniformly cream-coloured. The newly hatched young measure 27 mm. over all, of which length the tail accounts for 14 mm. Their colour in spirit is as follows :—Uniform dark brown or black above and below ; a broad, white, horseshoe-shaped band extending from eye to eye across the occiput ; tail with five or six pairs of white spots on its upper surface, the first pair at the base of the tail quite distinct, the remainder fused, the degree of fusion becoming progressively more complete backwards.

Traces of these caudal spots in the form of two transversely oval light markings may be detected on the tail of the adult type.

4. *Lepidoblepharis sanctæ-martæ* (Ruthven).

*Lathrogecko sanctæ-martæ*, Ruthven, Occ. Pap. Mus. Zool. Michigan, 1916, no. 21, p. 2, and Misc. Pub. Mus. Zool. Michigan, 1922, no. 8, p. 58 ; Barbour, Occ. Pap. Mus. Zool. Michigan, 1923, no. 120, p. 5.

5. *Lepidoblepharis xanthostigma* (Noble).

*Lathrogecko xanthostigma*, Noble, Proc. Biol. Soc. Washington, xxix. 1916, p. 87, and Am. Mus. Novitates, no. 4, 1921.

6. *Lepidoblepharis microlepis* (Noble).

*Lathrogecko microlepis*, Noble, Am. Mus. Novitates, no. 88, 1893, p. 2.

7. *Lepidoblepharis ruthveni*, sp. n.

*Lepidoblepharis festæ* (nec Peracca, 1897), Boulenger, Proc. Zool. Soc. London, 1898, p. 108, and Ann. & Mag. Nat. Hist. (8) i. 1908, p. 111 (footnote).

*Lepidoblepharis festæ* (nec Peracca, 1897), Peracca, Bol. Mus. Torino, xix. 1904, no. 465, p. 2.

Thanks to the kindness of the Director of the Zoological Museum of the University of Turin, it has been possible to compare a specimen from Rio Peripa, Ecuador, which was referred by Peracca to *L. festæ*, with one of the types of the species and with a specimen from Chimbo, Ecuador, which was also referred to *L. festæ* by Boulenger. There is no doubt that the Rio Peripa and Chimbo specimens are representatives of the same species, which, however, is apparently an undescribed one and not *L. festæ*. From this species the new one is readily distinguishable by its larger size, heterogeneous dorsal lepidosis, more numerous rows of ventral scales, and separate parietals. I am able to confirm Peracca's statement that in *L. festæ* the parietals are fused, and also to state that this condition is unique in the genus.

*Description of type* no. 98. 4. 28. 3 in the British Museum from Chimbo, Ecuador. Adult female:—

Snout pointed, as long as the distance from the posterior border of the orbit to the ear; ear-opening moderate, round or vertically elliptic; rostral large, with median cleft and U-shaped impression above, bounding the nostril anteriorly; four upper and four lower labials; mental large; no chin-shields; gular scales minute, granular. Body depressed, with a more or less definite median-dorsal groove from the nape of the neck to the base of the tail; covered above with small conical tubercles separated from one another by granules; upper surface of head and snout covered with uniform conical granules, much smaller than the tubercles on the back; on the tail the tubercles become backwardly directed and more closely set, being subimbricate at less than 10 mm. from its base; belly, anterior surface of fore limbs, lower surfaces of hind limbs and tail, and all the regenerated portion of the

tail with smooth, rounded, imbricating scales; ventral scales in twenty-two series at mid-body.

*Colour in spirit*.—Above dark brown, with irregular and indistinct lighter marblings; snout lighter. Beneath light brown, gular region and lower labials marbled with darker.

*Dimensions*.—Snout to ear-opening 9 mm.; width of head 6 mm.; snout to vent 46 mm.; tail (regenerated) 41 mm.; fore limb 12.5 mm.; hind limb 18 mm.

In the paratype (an adult ♀ from Rio Peripa, Ecuador) there are five upper labials and twenty-four longitudinal series of ventral shields at the mid-body.

### *Synopsis of the Species.*

Though it has not been possible to examine series of specimens of each species to determine the range of variation

Fig. 5.

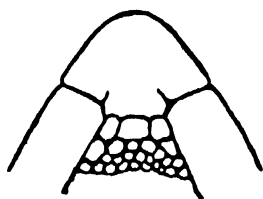


Fig. 6.

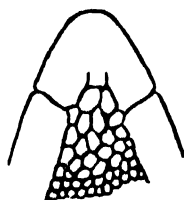


Fig. 5.—Mental and adjacent scales of *Lepidoblepharis xanthostigma*.

Fig. 6.—Ditto of *Lepidoblepharis intermedius*.

in various characters, the following synopsis shows the differences and resemblances of the species as they are at present defined :—

- (a). Dorsal scales imbricate. Digits short; subdigital lamellæ beneath the fourth toe 7-8 . . . . . *L. sanctæ-martæ*.
- (aa). Dorsal scales not imbricate. Digits longer; subdigital lamellæ beneath the fourth toe 10-17.
- (b). Dorsal lepidosis homogeneous.
- (c). Mental extending on the median line posterior to the labio-mental suture (fig. 5) and followed by definitely enlarged scales. *L. xanthostigma*.
- (cc). Mental not extending on the median line posterior to the labio-mental suture (fig. 6).
- (d). Scales on the snout larger than those on the back; mental followed by a few scales distinctly larger than the median gulars.

- (c) Dorsal scales granular, not keeled.  
 (f). Snout longer than the diameter of the orbit; ventral scales in 22-24 rows at mid-body. No longitudinal light stripes ..... *L. intermedius*.  
 (ff). Snout as long as the diameter of the orbit; ventral scales in 18 rows at mid-body. At least some indication of a dorso-lateral light stripe which meets its fellow on the base of the tail ..... *L. peracca*.  
 (ee) Dorsal scales strongly keeled or tubercular ..... *L. microlepis*.  
 (dd). Scales on the back larger than those on the snout; scales following the mental not larger than the median gulars; ventral scales in about 16 rows at the mid-body ..... *L. festæ*.  
 (bb). Dorsal lepidosis heterogeneous; mental not extending on the median line posterior to the labio-mental suture, and not followed by any enlarged scales. Ventral scales in 22-24 rows at mid-body ..... *L. ruthveni*.

## II. PSEUDOGONATODES, Ruthven.

*Pseudogonatodes*, Ruthven, Occ. Pap. Mus. Zool. Michigan, no. 19, 1915, p. 1.

*Lepidoblepharis* (nec Peracca), Noble, Ann. N.Y. Acad. Sci. xxix. 1921, pp. 133 & 135, and Am. Mus. Novitates, no. 4, 1921 (throughout); Ruthven, Misc. Pub. Mus. Zool. Michigan, 1922, no. 8, p. 58; Barbour, Mem. Mus. Comp. Zool. xvii. no. 3, 1921, pp. 218 & 220.

Digits short, cylindrical, the distal joints forming an angle with the basal portion, with smooth transverse lamellæ inferiorly; claw retractile vertically into a large compressed sheath composed of five scales—a pair of elongate infero-laterals in contact inferiorly, a pair of elongate supero-laterals in contact above, and a small terminal arising in the angle between the tips of the supero-laterals (fig. 2). Head and neck covered with small granular scales; body depressed; tail round; ventral and inferior caudal scales smooth, imbricate; dorsals tubercular or imbricate. Pupil round; eyelid well developed above. Rostral shield large, without any U-shaped impression on its upper surface. Clavicle moderately dilated; not perforated (fig. 8). Male without femoral pores.

Only two described species appear to belong to this genus:—

### 1. *Pseudogonatodes furvus*, Ruthven.

*Pseudogonatodes furvus*, Ruthven, Occ. Pap. Mus. Zool. Michigan, no. 19, 1915, p. 2; Noble, Ann. N.Y. Acad. Sci. xxix. 1921, p. 135.

*Lepidoblepharis intermedius* (nec Boulenger), Ruthven, Misc. Pub. Mus. Zool. Michigan, 1922, no. 8, p. 58.



2. *Pseudogonatodes barbouri* (Noble).

*Lepidoblepharis barbouri*, Noble, Ann. N.Y. Acad. Sc. xxix. 1921, p. 133, and Amer. Mus. Novitates, no. 4, 1921 (throughout).

These two species are readily distinguishable by the condition of the dorsal lepidosis:—

- |                                     |                      |
|-------------------------------------|----------------------|
| (a). Dorsal scales tubercular ..... | <i>P. furvus</i> .   |
| (aa). Dorsal scales imbricate ..... | <i>P. barbouri</i> . |

It has been suggested by Barbour\* that the species described as *Sphærodactylus meridionalis*, Boulenger, *S. scapularis*, Boulenger, and *S. amazonicus*, Andersson, are really referable to one of the two foregoing genera, on the grounds that they lack the supraciliary spine which is so characteristic of all the other species of *Sphærodactylus*. Examination of the types of *S. scapularis* shows that the supraciliary spine is present and that this species, in the composition of its unguis sheaths and in other characters, is a true *Sphærodactylus*. The types of *S. meridionalis*, however, have no supraciliary spine, and, in addition, the claw-sheaths, though definitely asymmetrical, are of a slightly different composition from those of *Sphærodactylus*; finally, the clavicle, though expanded, is not perforate. Barbour considers the presence of the supraciliary spine to be a character of generic importance; the clavicle in all the species of *Sphærodactylus* examined (ten) is perforate. These two important differences, in conjunction with the difference in the unguis sheath (which will be discussed more fully below), certainly seem to warrant the erection of a new genus for this species.

## COLEODACTYLUS, gen. nov.

Digits short, cylindrical, with smooth transverse lamellæ; claw obliquely retractile into an oval asymmetrical sheath composed of five scales—a pair of infero-laterals† (the outer much larger than the inner) in contact beneath, an elongate inner supero-lateral (no corresponding outer), a median dorsal separating the inner supero-lateral from the outer infero-lateral and a terminal lying between the tips of the infero-laterals and supero-lateral on the upper surface of the sheath (fig. 4). Head and neck covered with small juxtaposed granules; body depressed; tail round; body, limbs, and

\* Barbour, Mem. Mus. Comp. Zool. vol. xlvii. no. 3, 1921, p. 218.

† For discussion of the homologies of these scales see below.

tail covered with smooth imbricating scales. Pupil round ; eyelid moderately developed above. Rostral shield large,

Fig. 7.

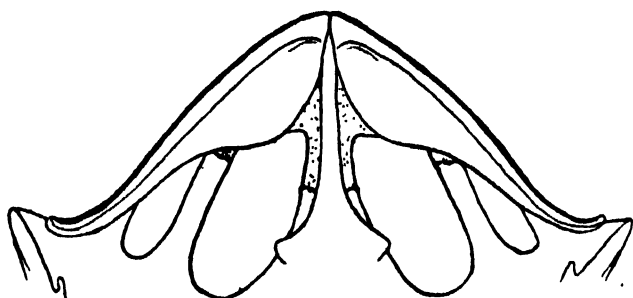


Fig. 8.

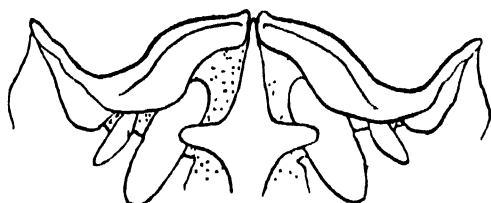


Fig. 9.

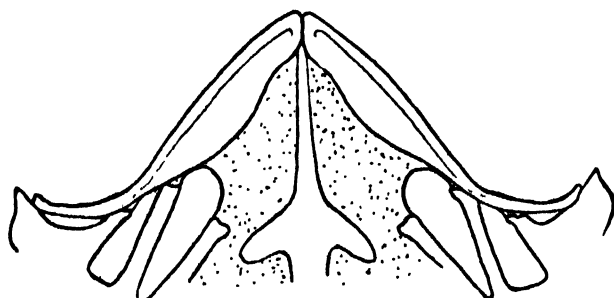


Fig. 7.—Clavicles of *Lepidoblepharis intermedius*.

Fig. 8.—Ditto of *Pseudogonatodes barbouri* (after Noble).

Fig. 9.—Ditto of *Coleodactylus meridionalis*.

without U-shaped impression on its upper surface. Clavicle dilated, not perforated. Males without femoral pores (?).

A single species :—

*Coleodactylus meridionalis* (Boulenger).

*Sphærodactylus meridionalis*, Boulenger, Ann. & Mag. Nat. Hist. (6) ii. 1888, p. 40.

The names used in describing the sheath-forming scales in the above generic description need explanation, since they do not harmonize with the scale homologies used by Noble in his discussion of the phylogenetic relationships of *Sphærodactylus*. Noble would derive *Sphærodactylus* from some *Pseudogonatodes*-like form, and bases this derivation, rather than from a *Lepidoblepharis*-like form, on the constitution of the ungual sheath. In comparing the two sheaths he homologizes the scales of one with those of the other, but without giving any reasons for these homologies. The result does not seem to be in accordance with the facts. The lettering used in the accompanying diagrams is the same as that used by Noble. The normal number of scales round the digits (excluding the inferior lamellæ) is odd (usually five) in *Lepidoblepharis*, *Pseudogonatodes*, *Coleodactylus*, and *Sphærodactylus*. In the last-named two genera, at least, reduction of this number may occur by elimination of a row, so that the number at the base of the claw-sheath is even. Where this happens, it is usually the second outer row which is lost, as shown here in the figure of *Coleodactylus meridionalis*. In many species of *Sphærodactylus* there is no reduction, and it is then found that the large scale marked *l* (outer supero-lateral) in Noble's figure belongs to the median series of scales (fig. 3, *b*); the same result is achieved if allowance is made for the elimination of a row (fig. 4). In consequence, this large scale must be regarded as a median element, and is apparently homologous with *b* (median dorsal) of *Lepidoblepharis*. The homologies of the remaining scales are suggested by a study of the claw-sheath of *S. microlepis*, A. Dumeril (fig. 3). Here, on the outer side of the median dorsal, is a small additional scale in the same relative position as the outer supero-lateral (*l*) of *Lepidoblepharis*. This scale occurs sporadically, and has been noticed in *S. microlepis*, *S. lineolatus*, *S. elegans*, and *S. cinereus*. The scale called by Noble *a* (terminal) is carinate like the other scales in *S. microlepis*, but the keel lies at its inner edge instead of in the middle line; this, coupled with the fact that there is a distinct terminal notch, suggests that this scale may in reality be double in its origin, representing both terminal and inner supero-lateral (*a* and *l*). In *Coleodactylus meridionalis*,

however, these two scales are quite distinct, for here there are obviously two inner laterals as well as the terminal. If these homologies are correct, the various types of ungual sheaths may be derived from a *Lepidoblepharis*-like form as follows:—*Pseudogonatodes*, directly by elimination of the median dorsal; *Coleodactylus*, directly by loss of the outer supero-lateral (and part of the corresponding digital scale-row), and great enlargement of the outer infero-lateral; *Sphærodactylus*, through a *Coleodactylus*-like form by fusion of the terminal and inner supero-lateral and still further enlargement of the outer infero-lateral—in this genus the outer supero-lateral may occasionally persist as a very small scale.

The other evidence adduced by Noble will support this view equally as well as his own, except the statement that "The clavicle of *Lathrogecko* [= *Lepidoblepharis*] is slightly more dilated than that of *Gonatodes*. In *Lepidoblepharis* [= *Pseudogonatodes*] it is still more expanded." A comparison of the figures will show that, though different in shape, the clavicle of *Pseudogonatodes* cannot be claimed to be "more expanded" than that of *Lepidoblepharis*; actually the degree of dilatation of the clavicle in all the four genera under discussion is of the same order of magnitude, and much stress cannot be laid upon it. Although it seems probable that Noble is wrong in trying to derive *Sphærodactylus* from a *Pseudogonatodes*-like form, the discovery of a genus of lizards which resembles *Sphærodactylus* in its asymmetrical claw-sheaths, but has the unperforated "Eublepharid" clavicle, serves to strengthen his more important conclusion—that *Sphærodactylus* and the neotropical "Eublepharids" form a natural group of genera.

## XLI.—Descriptions and Records of Bees.—CIX.

By T. D. A. COCKERELL, Boulder, Colorado.

### *Colletes miminca*, Cockerell.

Described from the male, taken at Matucana, Peru. At Tingo, Peru, I took five females, Aug. 17 to 22. This sex closely resembles the male in all respects, except the ordinary sexual differences, such as the short antennæ. The malar space is extremely long.

*C. miminca* was observed to visit Malvaceous flowers.

*Colletes tingoensis*, sp. n.

♂.—Length 8.5–9 mm., anterior wing 7 mm.

Black, shining, with long greyish-white hair, extremely long on face, at the sides of which it is mixed with black; black hair on vertex; thorax dorsally with very long hair, with black intermixed; mandibles black, obscure reddish at apex; labrum with distinct ridges; malar space very long, more than twice width of mandible; head very broad; antennæ entirely black, flagellar joints elongate, sutures constricted; mesothorax polished, with scattered weak punctures, scutellum more distinctly punctured; little ridges on base of metathorax close together; tegulæ dark brown. Wings very dilute brownish, stigma reddish, nervures dark. Legs shining black, hair on inner side of hind basitarsi white; spurs ferruginous. Abdomen shining, but finely punctured, with conspicuous broad hair-bands on the apical margins of the segments, the margins not discoloured; segments with thin erect white hair, very long on first; venter with thin hair-bands.

Tingo, Peru, 3 ♂, Aug. 22, 1925 (Cockerell).

Easily known from the last by the banded abdomen. It resembles the Argentine *C. longiceps*, Friese, but is smaller, with much black hair.

*Halictus (Chloralictus) hiemalis*, sp. n.

♀.—Length about 4.5 mm., anterior wing 3 mm.

Head and thorax olive-green; abdomen black, with the hind margins of segments brownish; legs black, with the knees, both ends of tibiae, and the tarsi entirely, chestnut-red; tegulæ rufo-testaceous, not punctured. Wings faintly dusky, brilliantly iridescent, stigma and nervures dilute sepia. Head rather small, circular seen from the front; mandibles chestnut-red with black base; clypeus and supraclypeal area highly polished, brassy-green, the clypeus sparsely punctured, its lower margin broadly black; front dull, minutely and densely punctured, not striate; scape long and black; flagellum rufescent beneath; hair of head and thorax white, scanty, abundant on cheeks; mesothorax highly polished, minutely and sparsely punctured, scutellum with smaller punctures; area of metathorax with widely spaced oblique rugæ, connected by irregular cross-wrinkles, the margin not shining; second cubital cell much more than half size of third. Abdomen highly polished, first segment almost entirely impunctate; third and following

segments with very thin white pubescence, not forming any distinct bands.

San Pedro de Jujuy, Argentina, in garden of Mr. R. G. Anderson, July (*Cockerell*).

I visited Argentina during the southern winter, and this is the only bee I was able to find. It is closely related to *H. vernalis*, Jörg., but distinguished by its bicoloured tibiae, abdomen without hair-bands, and other small characters. In the key to S. American *Chloralictus* by Miss Sandhouse, it goes to *H. chrysonotus*, Ellis; but that species has a much larger head, golden mesothorax, and paler and redder stigma.

*Halictus (Chloralictus) paitensis*, sp. n.

♂.—Length about 5.5 mm., anterior wing 4 mm.

Head and thorax olive-green, with thin white hair. Abdomen very dark brown, with a slight olivaceous cast. Legs black, the small joints of tarsi obscure reddish; tegulae rufo-testaceous, not punctured. Wings faintly dusky; stigma and nervures rufo-testaceous. Head rather large, broad; mandibles red, broadly black at base; clypeus and supraclypeal area well punctured, the former with apical half black; front dull, somewhat shining at sides, excessively densely punctured; scape long and black, flagellum very pale reddish clay colour beneath; mesothorax and scutellum dullish, moderately shining, closely punctured; area of metathorax large, appearing granular from dense vermiform rugae, margin not shining. Hind spur with three very long teeth. Abdomen polished, with pale short pubescence, conspicuous at base of second and third segments, and all over fourth.

3 ♀, Païta, Peru, Aug. 28 (*Cockerell*).

The type carries bright yellow pollen. One specimen, carrying creamy-white pollen, is a little smaller, the area of metathorax is shorter, with more distinct rugae at base and a shining rim. This is possibly a distinct species, but with no other specimens, and the other characters agreeing with *H. paitensis*, I do not feel justified in separating it. *H. paitensis* is allied to *H. spinolæ*, not to the species of Ecuador. It will be known by the rich olive-green of the densely punctured head and thorax, and very pale under side of flagellum.

*Halictus (Chloralictus) sublatens*, sp. n.

*Halictus (Chloralictus) spinolæ*, "Reed," Sandhouse, Journ. Wash. Acad. Sci., Oct. 1923, p. 384. (♀, Lima, Peru.)

Yura, Peru, 1 ♀, Aug. 23 (Cockerell); Arequipa, Peru, 1 ♀, Aug. 21 (Cockerell); the latter at a Malvaceous flower.

The Yura specimen has the scutellum brassy, in the other it is dark bluish green; there is also a little difference in the sculpture of the metathoracic enclosure, but I think all this represents individual variation. The species does not agree with *H. aricensis*, Schrottky, but I cannot separate it from *H. spinolæ* as described by Miss Sandhouse. The latter is the type of the new species.

Six males which I collected at Tingo, Peru, Aug. 22, are also placed here. The flagellum is very long, clay-yellow beneath except the last two joints. The mesothorax is shining, not dull as in the female; the same sexual difference, but still more pronounced, may be seen in *H. (Chloralictus) herbstiellus*, Friese, from Chile. The abdomen is pure black. The male, compared with the European *H. morio*, Fabr., differs at once by the lack of a light band on apex of clypeus, the more slender flagellum, and the clearer wings, but it is very similar.

This species is certainly the one which has passed in some quarters for many years as *H. spinolæ*, Reed, but it is not *H. paramorio*, Friese, as has been assumed. Reed based his *H. spinolæ* on the *H. minutus* of Spinola, from Chile. No description appeared until 1916, when Friese described *H. spinolæ* as a new species, from Concepcion. This must stand, whether the insect was that of Spinola and Reed or not. The female had the antennæ entirely black, except the two last joints brown beneath. The species described as *H. spinolæ* by Miss Sandhouse is certainly different, having the flagellum testaceous beneath. The specimen from Chile referred to by her (det. Schrottky as *spinolæ* in 1910) came from Arica.

*Halictus (Chloralictus) cyaneonitens*, sp. n.

♂.—Length about 4.5 mm.

Head and thorax steel-blue, with thin white hair. Abdomen blue, the hind margins of the segments broadly brownish black, the surface with thin white hair. Mandibles red apically; clypeus moderately produced, with no light band; flagellum conspicuously stouter and shorter than in *H. sublatens*, pale fulvous beneath; front entirely dull; mesothorax highly polished, the punctures few and inconspicuous; scutellum and postscutellum polished; area of metathorax large, appearing finely granular, with a shining posterior

rim; tegulæ very dark reddish brown. Wings hyaline, stigma pale, dull reddish. Legs black, with pale hair.

Santiago, Chile.

Received as "*Halictus minutus*, Lep.," probably so named by Reed, and identical with the undescribed *H. spinolæ*, Reed, but certainly not *H. spinolæ*, Friese. In the Chilean fauna it falls next to *H. herbstiellus*, Friese, differing at once by the steel-blue colour and rather smaller size. I think it is too distinct to be a mere variety of *H. herbstiellus*.

*Halictus (Chloralictus) aricensis*, Schrottky.

I thought the Arica specimen referred to *C. spinolæ* by Schrottky might belong here, but it was determined in the same year that he had just published *H. aricensis*, from which he clearly differentiated it. The male, especially, is quite different in the two species. The Arica country is of the same kind as Southern Peru, and it is probable that *H. sublatens* does not exist in Central and Southern Chile, where *H. spinolæ* is found.

*Cænohalictus purpurissus* (Vachal).

♀.—Upper margin of clypeus magenta; sides of face (except black next to eyes) crimson; front green suffused with red; mesothorax dull, brilliant magenta, the margins golden; scutellum magenta, but axillæ greenish golden; stigma lighter and redder than in *C. purpurissus rostraticeps* (Friese).

♂.—Not appreciably different from *C. p. rostraticeps*.

The above description is based on my specimens from Peru; Vachal's male, from Arica, had a little coppery colour on face and mesonotum.

Both sexes from desert near Arequipa, Peru, toward Mt. Misti, female at flowers of a large cactus, *Trichocereus fascicularis* (Meyen), Aug. 21 (Cockerell); both sexes at Tingo, Peru, male Aug. 18, female Aug. 22 (Cockerell).

In spite of the splendid colours of the female, this is certainly only racially distinct from the Chilean bee which Friese named *Halictus rostraticeps*.

*Cænohalictus cuprellus* (Vachal).

1 ♀, Tingo, Peru, Aug. 22 (Cockerell).

The stigma is light reddish.



*Cænohalictus dilutior* (Vachal).

2 ♀, Tingo, Peru, Aug. 16 and 22 (*Cockerell*).

I feel sure this is Vachal's species, though he overlooked the fact that the femora and scape are green. It is extremely close to *C. smaragdulus* (Fries), but differs (♂) by the smaller amount of yellow on clypeus and labrum, anterior tibiae not pale in front, darker stigma, and bright ferruginous tarsi.

*Cænohalictus smaragdulus* (Fries).

I have specimens taken by Herbst at Valparaiso.

It is supposed that the prior name *scitulus* of Vachal applies here, but as Vachal described his species under *Halictus* and there is a much earlier *H. scitulus*, Smith, the name proposed by Fries remains valid.

*Cænohalictus*, Cameron, was published July 1903. *Paragapostemon*, Vachal, which included many species of *Cænohalictus*, was published in 1903, the month unknown to me. Taking *P. podager* (Vachal), the first species of *Paragapostemon*, as the type, Vachal's designation applies to a group at least subgenerically distinct from true *Cænohalictus*.

The species usually known as *Halictus mutabilis* and *H. nigrocæruleus*, Spinola, will stand as *Cænohalictus mutabilis* (Spin.) and *C. mutabilis nigrocæruleus* (Spin.), the latter being a distinct colour-variety.

*Lithurgus apicalis*, Cresson.

Females from near Boulder, Colorado (*Clarence Custer*), have the hair at end of abdomen sometimes darker than in the typical form, yet not nearly so dark as in the race *opuntiae*, Ckll.

Dalla Torre, in his Catalogue, erroneously gives Nevada as the locality for *L. apicalis*.

*Triepeolus custeri*, sp. n.

♂.—Length nearly 10 mm.

Black, with creamy-white ornaments, hair of face pure white; mandibles red, with black tip and base; labrum black; eyes pale green; antennæ black; tubercles and axillæ black; tegulæ testaceous, with a large rufous patch. Wings faintly dusky. Legs bright ferruginous, spurs black. Clypeus bare, minutely granulate; face above clypeus, to a little above level of antennæ, densely covered with appressed

snow-white hair ; upper border of prothorax densely hairy ; mesothorax thinly hairy along anterior margin, but with no stripes ; dense white hair just before axillæ and a broken band of the same in scutello-mesothoracic suture ; area of metathorax covered with hair except in middle ; lower part of mesopleura bare, finely and very densely granulated as seen under a lens ; hair on inner side of hind basitarsi golden. First abdominal segment densely covered with hair except a broad transverse band ; segments 1 to 6 with broad entire apical bands ; second segment with lateral extensions of black forming very acute angles, but the tip of the extension obtuse ; apical plate red.

White Rocks, near Boulder, Colorado, Sept. 18, 1925 (Clarence Custer).

In my table of Rocky Mountain species this runs nearest to *T. balteatus*, Ckll., but the pattern of the hair on second abdominal segment is quite different, and there are many other differences. In the table of Pacific Coast species it runs to *T. schwarzi subcalens*, Ckll. & Sandh., but that is much smaller, with narrower apical plate of abdomen, differently coloured antennæ, &c.

*Psænythia rufipes*, Holmberg.

When describing *P. pachycephala* in 1917, I stated that it was very close to *P. rufipes* of Holmberg, differing in the face-markings. I also cited Schrottky to the effect that *P. rufipes* was a variety of *P. picta*. Dr. Holmberg has now published a revision of the genus, in which he shows that *P. rufipes* is a very distinct species, and corrects his former ambiguous account of the face-markings. I am thus able to ascertain that *P. pachycephala*, Ckll., is a synonym.

*Nomada vierècki*, Cockerell, race *cushmani*, nov.

*Nomada putnami*, Cockerell, Proc. U.S. Nat. Mus. vol. xxxix. p. 651 (1911). (Laredo, Texas, R. A. Cushman.)

I recorded this insect as *N. putnami*, Cresson, remarking that it might prove distinct. I now have a female of genuine *N. putnami*, taken in Boulder County, Colorado, June 13 (Clarence Custer).

The species from Texas is closely allied, but much less robust, region at each side of clypeus red ; lateral marks produced more than halfway up sides of front, ending very obtusely ; mesothorax rather more densely punctured ; yellow patch on mesopleura much larger, extending right

across; a small yellow spot on inner corner of each axilla; metathorax red except middle of basal area. Dark colour of wings practically confined to broad apex, marginal cell, and first two cubitals. Abdomen not nearly so broad, first segment (except the band) red; second segment with the dark part closely and finely punctured all over (in *putnami* less closely punctured and with a smooth band in middle); hair of venter white (brown in *putnami*). Hind coxæ without a yellow spot behind.

I thought to give a new specific name to the bee from Laredo, but on careful comparison with *N. vierecki*, Ckll., I am sure it represents only a race of that species, distinguished by the larger size (length about 9 mm.) and yellower markings.

*Nesoprosopis volcanica*, Perkins.

Volcano House, Hawaii, August, both sexes (*Cockerell*).

*Nesoprosopis pubescens*, Perkins.

Volcano House, Hawaii, August, both sexes (*Cockerell*).

*Nesoprosopis fuscipennis*, Smith.

Mt. Tantalus, Oahu, Hawaiian Is., many specimens (*Cockerell*).

This is apparently much more common now than in Blackburn's time. It is known that Blackburn worked over the district where mine were collected, but he found it "rarely," and got only a single female. Among my specimens are two males and a female which may be separated thus:—

*Nesoprosopis fuscipennis*, mut. *swzeyi*, nov.

♂ (type).—Flagellum ferruginous beneath; small joints of tarsi dark or reddish apically. Female with flagellum ferruginous beneath and first two joints of tarsi black or almost.

Named after Mr. O. H. Swzey, who accompanied me when I collected the specimens on Mt. Tantalus.

I should hardly think of separating this form, were it not for the great interest attaching to the variation or evolution of these insular insects. Crampton has shown that remarkable changes may occur in snail populations within half a century, and it may be that the insects, if similarly intensively studied, will prove no less interesting. The form now

named has in part the characters of var. *obscuripes*, Perkins, but the wings are not more iridescent than the type. The true *obscuripes* is confined to West Maui. It is a singular thing that in the *swezeyi* form the darkening of the tarsi is coincident with a reduction of pigmentation in the antennæ.

*Nesoprosopis koæ*, Perkins.

Both sexes, Mt. Tantalus, Oahu, July 16 (*Cockerell*).

Perkins, in his original description, gives only the female, but in his later-published table he cites the male, and I have a male from him.

The male has the clypeus pale yellow, narrowly black at sides; no other face-markings; legs black, with anterior tibiæ testaceous in front.

XLII.—On Mammals from Gorgona Island, with the Description of a new Sloth. By OLDFIELD THOMAS.

THE mammals as yet recorded from Gorgona Island, off the coast of Colombia, are few in number, and the fauna is undoubtedly very poor. In 1905\* Mr. Bangs gave a general account of it, and described as new local members of *Cebus* and *Proechimys*, while an Agouti (*Dasypsecta pandora*) was named by me in 1917† on a specimen collected during the voyage of U. S. S. 'Pandora,' and presented to the Museum in 1850 by Capt. Kellett and Lieut. Wood.

During the recent voyage of the yacht 'St. George,' under the auspices of the Scientific Expeditionary Research Association, a visit was made to the island, where both Col. H. J. Kelsall and Mr. P. H. Johnson collected what mammals they could, and succeeded in obtaining examples of the monkey and spiny rat, of *Saccoteryx bilineata* and *Carollia perspicillata*, bats common on the mainland, but new to the local list, and in addition each captured a sloth, which I have now had the opportunity of studying. This animal proves, like the three other terrestrial mammals of the island, to be a distinct form, and may be described as follows:—

*Bradypus gorgon*, sp. n.

Size small, about as in *tridactylus*, *infuscatus*, and *ephippiger*, the skull markedly smaller than in the Ecuadorean

\* Bull. Mus. Harv. xlv. p. 89.

† Ann. & Mag. Nat. Hist. (8) xx. p. 313 (1917).

*macrodon*. General colour of the usual coarsely mottled grey, the ground-colour perhaps a little paler than in specimens referred to *B. ephippiger* and *infuscatus*. Speculum of male large, with an unusually broad median black band (20 mm.) ; its sides without supplementary black spots or edging, dull yellowish, continued backwards as white stripes down the back. Face coloration peculiar in the nearly complete suppression of the usual markings, the light forehead band being only represented by a narrow patch in the centre, the eye-streaks by a dull brownish discoloration of the hairs quite different from the usual well-marked blackish band, while the cheeks down to the lips are also brown instead of there being a second light band below the dark one. Both male and female are alike in this reduction of the face-markings, although the female has rather more of the light forehead band, but it is still very small in comparison with that of other species.

Skull small, strongly ridged, narrow, both across the zygomata and over the frontals, decidedly smaller than in *macrodon*, and with less convex frontals than in *violeta*. Teeth small, a little smaller than those of *griseus* and *castaneiceps*, much smaller than those of *macrodon* and *violeta*.

Skull and teeth of female closely similar to those of the male, except that the mesopterygoid space is decidedly broader.

Skull-dimensions of type :—

Greatest length from condyle to front of nasals 78 mm. ; condylo-basal length 74 ; zygomatic breadth 45 ; breadth of muzzle 16 ; interorbital breadth 22 ; greatest breadth across frontals 28 ; intertemporal breadth 20 ; mastoid breadth 38.5 ; palatal length (median) 22.5 ; greatest diameter of pseudo-canine 48, of  $m^1$  4.

*Type*. Old male. B.M. no. 24. 12. 6. 17. Original number 7. Collected 3rd July, 1924, by Col. H. G. Kelsall. The female collected 14th November, 1924, by Mr. P. H. Johnson. Both presented by the Scientific Expeditionary Research Association.

The discovery of this new sloth is an interesting result of the visit of the 'St. George' to the island, both as adding a fresh member to the small Gorgona list and a new species to so remarkable a genus as *Bradypus*. Col. Kelsall and Mr. Johnson are to be congratulated on this notable reward for the trouble they took in collecting Mammalia.

The species is readily distinguishable by the proportions

of the skull, the comparative suppression of the face-markings, these being particularly conspicuous in *B. ephippiger* of the Colombian Mainland \*, as may be seen by Philippi's figure †, and by the absence of lateral supplementary black spots on the speculum of the male.

Col. Kelsall makes the following note on his specimen :—  
“Slowly climbing a tree in very dense jungle 150 yards from the shore. A number of small beetles were found in the fur.”

#### XLIII.—Two new Mammals from North Argentina.

By OLDFIELD THOMAS.

IN a collection of mammals presented to the National Museum by Mr. Stewart Shipton of Concepcion, Tucuman, there occur examples of the following :—

##### *Grissonella shiptoni*, sp. n.

A small species, the lighter markings buffy.

Size small, smaller than in any species except the S. Chili *G. cuja*. Coloration approximately as in the Chilean *melina* and *cuja*, not nearly so strongly and broadly washed with buffy as in the N. Bolivian *luteola* on the one hand, or so greyish and without buffy as the San Juan *ratellina* on the other. Facial band strong clear buffy. Dorsal lines with a narrow subterminal band of pale buffy. Tail with a slight admixture of buffy-ringed hairs.

Skull of female smaller and with a narrower brain-case than in *luteola*, the buffy-coloured Bolivian form. That of the male perhaps attaining the size of that of *ratellina*, but only young skulls of this sex are available. The female skull, however, has much smaller bullæ than the male *ratellina*, while in a good series of *huronax* the bullæ of the females are approximately the same size as those of the males.

Dimensions of the type :—

Head and body 338 mm. ; tail 150 ; hind foot 52 ; ear 28.

Skull, condylo-basal length 68·3 mm. ; upper median

\* Cf. Ann. & Mag. Nat. Hist. (8) xix. p. 355 (1917).

† Arch. f. Nat. xxxvi. p. 263, pl. iii. (1870).

length 61·5; zygomatic breadth 39·5; interorbital breadth 15·6; intertemporal breadth 15·5; mastoid breadth 36·5; palatal length 34·3; length of bullæ from the concavity in front to the back of the paroccipital process 16; transverse diameter of  $m^1$  5·3.

*Hab.* Tucuman. Type from Concepcion.

*Type.* Old female. B.M. no. 25. 12. 13. 3. Original number 11. Collected 13th June, 1925, by Juan Morgensen; presented by Stuart Shipton, Esq. Three specimens, two young males and the old female.

This huron is decidedly smaller than the East Argentine *G. huronax*, is much less buffy than the Bolivian *lutreola*, and more buffy, less grey, than *ratellina* of San Juan.

It is named in honour of its donor, Mr. S. Shipton, to whom we owe so many acceptable mammals from Concepcion and Mt. Aconquija, including the remarkable cavy *Nanacavia shiptoni*, the fine tuco-tuco *Ctenomys tuconax*, and some interesting Muridæ, to which I would now add the following:—

*Bolomys negrito*, sp. n.

A very dark-coloured fossorial species.

Size about as in *B. albiventer*. General colour finely ticked blackish olivaceous, the median area of the back so heavily blackened by the ends of the long hairs as to appear quite black, the sides more grizzled. Under surface dark smoky brown, the bases of the hairs dark slaty, the ends brown with a slight ochraceous tone. Ears black. Chin prominently contrasted white, as in *B. lactens*. Feet dark brown above, specialized for digging, the claws lengthened, the fourth anterior 4·1 mm. in length.

Skull strongly fossorial in shape. Supraorbital edges sharply squared; not beaded. Palatal foramina long, narrowed behind, penetrating between the molars. Capsule of lower incisor-root very prominent, reaching two-thirds the distance from the coronoid to the condyle.

Incisors proodont, index 90°; the upper almost white, the lower pale yellow.

Dimensions of the type:—

Head and body 120 mm.; tail 70; hind foot 23·5.

Skull, palatilar length 14 mm.; front of incisors to back of  $m^3$  16; zygomatic breadth 14; nasals  $9 \times 3·3$ ; interorbital breadth 5; palatal foramina 6·8; upper molar series (much worn) 5·5.

*Hab.* Aconquiza—type from Las Paras, about 4000 m.

*Type.* Adult male. B.M. no. 25. 12. 13. 39. Original number 19. Collected 12th December, 1924, by Juan Morgensen, and presented by Mr. Stewart Shipton.

This remarkable species is widely different from any other by its dark colour and the fossorial characters of its feet and teeth.

**XLIV.—*The Godman-Thomas Expedition to Peru.—I. On Mammals collected by Mr. R. W. Hendee near Lake Junin.***  
By OLDFIELD THOMAS.

IN pursuance of its objects in furthering tropical exploration for the benefit of our National Museum, the Trustees of the Godman Exploration Fund have contributed towards the expenses of a collecting-trip now being carried out by Mr. R. W. Hendee in Peru, a country whose exploration falls in very naturally with the Neotropical work done by Dr. Godman during his life-time.

The first consignment is from the neighbourhood of Lake Junin, on the plateau a little north of Lima, a region whence came the specimens collected by Dr. Jelski in 1881, on which one of my earliest papers on Neotropical mammals was based. Dr. Jelski's specimens having been all preserved in spirit, the present series of skins, admirably prepared in modern fashion, makes a most useful supplement to them.

This preliminary collection consists of 120 specimens belonging to 16 species and subspecies, of which a *Phyllotis* and a *Hesperomys* prove to need new names. Incidentally a new generic name is given to "*Phyllotis*" *gerbillus*.

The following are the localities at which Mr. Hendee worked :—

*Oroya*.—On the plateau inland of Lima, about 50 km. S.E. of Lake Junin, on the Oroya River. 12,000'.

*Hacienda Atocsaico*.—A ranch about 20 km. S.W. of Junin town. Its manager, Mr. Angus MacLeod, was of much service to Mr. Hendee, and himself contributed several specimens to the collection. 13 500'.

*Yana Mayo, Rio Tarma*.—A farm on the side-road between Tarma and Chanchamayo. Most of the trapping was done on the Yana Mayo stream, which runs into the Rio Tarma. 8500'.



1. *Pseudalopex culpæus andina*, Thos.

♂. 53. Hacienda Atocsaico, Junin. 13,500'.

A fine old specimen representing this recently described subspecies. Presented by Mr. Angus MacLeod.

2. *Mustela agilis*, Tsch.

♂. 121. Yana Mayo, Rio Tarma. 8500'.

This may be considered a topotype of Tschudi's species, as the example whose habits he described was seen in the town of Tarma. The coloration is very variable, and I should now consider both *M. aureoventris*, Gray, and *M. macrura*, Taczanowski, as synonyms of *M. agilis*.

3. *Oryzomys stolzmanni*, Thos.

♂. 89, 96, 107, 108, 110, 112, 116, 125, 128; ♀. 77, 79, 105, 106, 109, 127.

Yana Mayo, Rio Tarma. 8500'.

4. *Microryzomys aurillus*, Thos.

♂. 81; ♀. 90, 114, 115. Yana Mayo, Rio Tarma. 8500'.

In view of the large number of species of true *Oryzomys*, it seems advisable to treat *Microryzomys* as a full genus.

5. *Thomasomys* sp.

♂. 118. Yana Mayo, Rio Tarma.

Perhaps *T. cinereus ischyru*s, Osg., but too immature for certain determination.

6. *Hesperomys frida miurus*, subsp. n.

♂. 48, 50. Hacienda Atocsaico, Junin. 13,500'.

♂. 72; ♀. 64, 67. Oroya. 12,000'.

♂. 78, 82, 87, 91, 111, 117, 119, 120, 124; ♀. 86, 92, 98, 98, 101 (in. al.), 104, 122 (in. al.), 123. Yana Mayo, Rio Tarma. 8500'.

Apparently quite similar to the typical *frida* of the Cuzco neighbourhood, but the tail uniformly shorter. The type of *frida* had a tail 91 mm. in length, four adults in the British Museum have it 87, 85, 85, and 82, while of the considerable Junin series the longest-tailed specimen has it only 80; in the great majority it is from 70 to 75 mm. in length. Mammæ, as in true *frida*, 2—2=8.

Dimensions of the type:—

Head and body 86 mm.; tail 76; hind foot 19; ear 17.

Skull: greatest length 26.6; condylo-incisive length 23.6; breadth across brain-case 11.2; upper molar series 8.6.

*Hab.* As above; type from Yana Mayo.

*Type.* Old male. B.M. no. 26.2.1.26. Original number 120. Collected 10th July, 1925.

This laucha agrees closely with *H. frida* in size and colour, and has the same mammary formula, but may be readily distinguished by its shorter tail. Its shorter foot and tail will also separate it from *Phyllotis amicus* and *elegantulus*. It was not obtained by Dr. Jelski.

The study of these specimens shows that there is very great difficulty in assigning some of the northern forms of the group to their proper genera. In the south, in Argentina and Bolivia, no one could have any hesitation in distinguishing *Phyllotis*, hypsodont, long-tailed, and with 8 mammae, from *Hesperomys*, brachyodont, short-tailed, and (in that region) with 10 to 18 mammae. But in the north, where all have 8 mammae and the teeth are less hypsodont, some of the forms tend to be intermediate, and discrimination is not so easy.

After a careful study of the teeth (in which I have had the advantage of Mr. Hinton's collaboration) and of the other characters, cranial and external, of the species concerned, I come to the conclusion that the animals that have been called *Phyllotis haggardi*, *andium*, *elegantulus*, and *amicus* are rightly so referred, having teeth essentially similar to those of true *Phyllotis*, though not so hypsodont, that *Hesperomys frida* is also correctly placed, but that the beautiful little "*Phyllotis*" *gerbillus* of the Peruvian coast desert is more nearly allied to the *Eligmodontia* of Bolivia and Argentina than to either of the other genera.

But its feet have not the specialized hairy soles of *Eligmodontia*, in which the normal pads are greatly reduced, while on the centre of the distal part of the granulated sole a large hairy cushion is developed, very much as in certain Old World genera, such as *Cricetiscus* and *Gerbillus*. In *Phyllotis gerbillus*, on the other hand, the normal six pads are clearly defined, and the soles are naked, with the exception of a few minute scattered hairs. It would seem, therefore, that this animal, strikingly peculiar as it is by its Gerbil-like coloration, should be made the basis of a special genus, for which I would suggest the name of *Paralomys*, from its coastal habitat.

The genus has a very restricted range, as *Paralomys gerbillus* has as yet only been obtained at Piura and Catacaos in the desert of Sechura, and was not found by either Messrs. Osgood or Simons at Eten, Pacasmayo, or Trujillo, quite a short distance to the southward.

The species described as *Eligmodontia sorella*, *ducilla*, and

*carilla* have already been recognized as members of *Hesperomys*.

7. *Phyllotis abrocodon*, sp. n.

♂. 1, 2, 56, 57, 58, 60, 63, 65, 70, 71; ♀. 59, 62. Oroya. 12,000'.

A large-eared pericote of the *P. darwini* group, with light-coloured incisors.

Size about as in *P. darwini*. General colour above of the usual grey, rather more tending towards brownish on the hinder back; sides slightly clearer, dull buffy; under surface soiled grey, the bases of the hairs dark slaty, their tips dull whitish. Head greyer than back. Ears large, blackish brown, an inconspicuous tuft of whitish hairs at their outer bases. Hands and feet white. Tail long, well-haired, more or less pencilled terminally, blackish above, more intense distally; its underside either wholly white as usual or darkened towards the end.

Skull very much as in *P. darwini posticalis*, the nearest geographical ally. Supraorbital edges sharply angular, but for a distance rather less than in old specimens of *posticalis*. Palatal foramina scarcely penetrating between molars. Bullæ slightly larger.

Incisors narrow, their front surface of a paler colour than usual, the outer fourth of it being practically white, the teeth therefore looking like those of *Galea*, or, still more, like those of *Abrocoma*, to which the resemblance is striking. This character occurs in twelve specimens, while I can find no other *Phyllotis* presenting it.

Dimensions of the type:—

Head and body 122 mm.; tail 137; hind foot 28; ear 26·5.

Skull: greatest length 31·5; condylo-incisive length 29; zygomatic breadth 16·3; nasals 13; interorbital breadth 4; breadth of brain-case 14; palatal foramina 7·5; oblique diameter of bullæ 5·5; upper molar series (worn) 5·2.

*Hab.* As above.

*Type.* Old male. B.M. no. 26.2.1.39. Original number 60. Collected 25th June, 1925.

The character which distinguishes this pericote from its allies, the pale white-edged front of the incisors, is a very unusual one in Muridæ, but its uniformity throughout the series is such that we cannot ignore it. Quite similarly-coloured incisors occur in *Abrocoma*, on which, in an abbreviated form, I have based the name.

The greyish head and brownish rump of this animal show a certain tendency towards the coloration of *Auliscomys pictus* in its greyer forms.

It is of good omen that the very first animal captured by Mr. Hendee should be of this interesting new species.

"Trapped among rocks on railroad; very common."—*R. W. H.*

8. *Auliscomys pictus*, Thos.

♂. 8 (young), 9, 10, 23, 38, 41, 43, 49; ♀. 4, 6, 39, 42. Junin. 13,000'.

Topotypes of the species.

The three subgenera into which *Euneomys* has been divided, largely on Mr. Osgood's work \*, being undoubtedly natural groups, I propose to consider them as full genera, as this course is so far more convenient both for labelling and reference.

I may recall that *Euneomys fossor* has been recently separated as a special genus, *Chelomyscus* †.

9. *Neotomys ebriosus*, Thos.

♂. 24, 54; ♀. 37. Hacienda Atocsaico, Junin. 13,500'.

Type-locality: Vitor, Chanchamayo River-system. Not to be confused with Vitor, Arequipa.

10. *Akodon mollis*, Thos.

♂. 73, 74, 75, 80, 81, 85, 94, 95; ♀. 76, 83, 99 (in al.), 100 (in al.), 102, 103. Yana Mayo, Rio Tarma. 8500'.

11. *Akodon puer*, Thos.

♂. 26, 31, 32, 33, 34, 44, 45; ♀. 35. Hacienda Atocsaico, Junin. 13,500'.

♂. 66; ♀. 61, 69. Oroya. 12,000'.

This small *Akodon* has not been hitherto recorded from Peru, but I now find that the Jelski specimens from Junin, included in my 1884 paper as "*Hesperomys (Habrothrix) xanthorhinus*," are also referable to it. It is distinguishable from *A. mollis* by its smaller size, yellower colour, and very small teeth.

12. *Chæomys jelskii*, Thos.

♂. 25, 28, 29, 36, 40, 46; ♀. 22, 27. Hacienda Atocsaico, Junin. 13,500'.

♂. 55 (in spirit). Yana Mayo, R. Tarma. 8500'.

13. *Chæomys jelskii pyrrhotis*, Thos.

♂. 68 (young). Oroya. 12,000'.

♀. 126 (young). Yana Mayo, R. Tarma. 8500'.

\* Field Mus. Publ. Zool. x. p. 190 (1915).

† Ann. & Mag. Nat. Hist. (9) xv. p. 584 (1925).

Type-locality: Maraynioc, Aynamayo River, near Chanchamayo.

For the moment I record these specimens under the name originally used for the animal, but, owing to the fact that all the available specimens of *pyrrhotis* are more or less immature, while all those of *jelskii* are adult or old, I am doubtful whether on the one hand the two are age-stages of the same animal, or on the other are wholly different species, as seems probable from their very different colour.

14. *Lagidium inca*, Thos.

♂. 3, 7, 13, 30, 51; ♀. 11, 12, 47. Lake Junin. 13,500'.  
Practically topotypes. The original type was hitherto the only specimen recorded.

15. *Cavia tschudii umbrata*, Thos.

♂. 5, 15, 18, 19. ♀. 16, 17, 20, 21. Lake Junin. 13,000'.

Three of these specimens agree with the type in being grey with a blackened back, while in the others the general darkening is increased until in some cases the whole animal is glossy black.

Type from Incapirca, Zezioro, Junin

"On an island in the Lake."—R. W. H.

16. *Vicugna vicugna*, Mol.

♀. 52 (half-grown). Young, without number. Hacienda Atocsaico, Junin. 13,500'.

"Shot on grassy hill."—R. W. H.

17. *Didelphis paraguayensis pernigra*, All.

♂. 88, 113; ♀. 79. Yana Mayo, Rio Tarma. 8500'.

XLV.—*The Spedan Lewis South American Exploration.*—

II. *On Mammals collected in the Tarija Department, Southern Bolivia.* By OLDFIELD THOMAS, F.R.S.

IN the 'Annals' for last May an account was given of a collection made for Mr. Spedan Lewis's Exploration by Señor E. Budin in Southern Bolivia, and the present paper is based on a further consignment from a neighbouring

region, but one where the fauna is so different that hardly a single species is common to the two collections. And in some cases, as in that of the pygmy opossums of the genus *Marmosa*, different species of the same genera represent each other in the two districts, thus showing a definite faunistic difference between them. And, again, of four akodons in the previous collection, and three in the present, not one is common to both. All this indicates how rich and how little known the Fauna of Bolivia still is.

In the present series we get a greater number of purely Bolivian forms, such as those discovered by Mr. Perry Simons in the Cochabamba region to the north, and we are thus helped to understand the distribution of Mammalian life in these little-worked districts.

The localities of the present collection are as follows:—*Tablada*, 2000 m., close to the town of Tarija; *Carlazo*, 2300 m., 40 km. to the east of that town; *Tambo*, 2200 m., 75 km. east, and *Pinos*, 1700 m., 100 km. east; all at a comparatively low elevation.

These places are all exceedingly wet, the rain being nearly continuous.

*Sama*, 50 kilometres to the west of Tarija, but at a much higher altitude, 4000 m., which results in a certain similarity in fauna to the highlands of Jujuy in North Argentina. This locality proved to be particularly rich in interesting species.

Of novelties, special attention may be drawn to the splendid proodont tuco-tuco (*Ctenomys lewisi*), whose semi-aquatic habits, in marked contrast to those usual in the genus, have attracted Sr. Budin's peculiar interest. He has made such a hobby of this characteristic genus, and discovered so many new species of it, that his observations are well worthy of attention. The new *Marmosa*, of a Chaco and Paraguayan group, is also a noteworthy discovery, the further Akodont Muridae are highly acceptable, and, finally, the exact definition of the eastern extension of the Mountain Viscachas (*Lagidium*) enables us to map their distribution more exactly.

The collection consists of 200 specimens belonging to 21 species and subspecies, of which 5 require descriptions as new.

1. *Pseudalopex culpaeus andina*, Thos.

♂. 1877. Tambo, 2200 m.

2. *Conepatus chorensis*, Thos.

♀. 1889, 1904. Carlazo, 2300 m.

Agree closely both in colour-pattern and the small size of the upper molar with *C. chorensis* of N. Bolivia, and equally differ in these respects from *C. porcinus* of the same region. With these variable animals, whose characters and ranges are still very little known, additional material is of the utmost value, while the present is a considerable extension of the known range of *C. chorensis*.

3. *Andinomys edax*, Thos.

♂. 1865, 1867. Pino, 1700 m.

♂. 1957, 1986, 1991; ♀. 1928, 1929, 1933, 1936, 1960, 1961, 1962, 1983, 1987. Sama, 4000 m.

This fine rat varies considerably in size, No. 1865 having a skull-length of no less than 38 mm., while others, fully adult, have this dimension barely 35 mm.

4. *Graomys taterona*, sp. n.

♂. 1798, 1800, 1801, 1806, 1807, 1830, 1849, 1850;

♀. 1797, 1802. Tablada, 2000 m.

A large species of a pale gerbil colour.

Size large, form robust. General colour above pale buffy or gerbil colour, considerably paler than in other species, the head greyer than the back. Sides clear pale buffy, contrasting both with back and belly. Under surface white, though not snowy white, the bases of the hairs, except on the chin and throat, generally slaty; line of demarcation on sides not sharply marked. Proectote of ear blackish. Hands and feet white. Tail dark above and white below, but neither so sharply contrasted nor with such lengthened hair terminally as in *G. lockwoodi*.

Skull large and robustly built, larger and heavier than in the allied *G. lockwoodi*. Cranial ridges strong. Bullæ of medium proportional size, smaller than in *lockwoodi*, larger than in *domorum*. Palatal foramina long, not widely open.

Dimensions of the type:—

Head and body 152 mm.; tail 161; hind foot 30; ear 25·5.

Skull: greatest length 38; condylo-incisive length 34·7; zygomatic breadth 19; nasals 15·5; interorbital breadth 7; palatilar length 16; palatilar foramina 7·7; upper molar series (worn) 5·4.

*Hab.* as above.

*Type.* Old male. B.M. no. 26. 1. 1. 16. Original number 1801. Collected 5th December, 1924.

This new species is readily distinguishable by its size and pale buffy colour, much paler than in *G. lockwoodi*, to which it is probably most nearly allied. In size it is only equalled by *G. chacoensis*, Allen, of Paraguay, which has larger bullæ and a snowy-white belly.

5. *Phyllotis wolffsohni*, Thos.

♂. 1934; ♀. 1930, 1992. Sama, 4000 m.

Type-locality: Tapacari, N. Bolivia.

6. *Phyllotis lutescens*, Thos.

♂. 1862. Pino, 1700 m.

Type-locality: Choro, N. Bolivia.

7. *Hesperomys secundus*, sp. n.

♂. 1799, 1823, 1837, 1842, 1843, 1844, 1847; ♀. 1821, 1822, 1825, 1826, 1828, 1836, 1845. Tablada, 2000 m.

♂. 1909. Carlazo, 2000 m.

Like *H. venustus*, but with fourteen mammae.

Size among the largest of the genus. Colour and general appearance very much as in the *H. venustus* of Cordova and Salta, with the same drabby-grey back, clearer and more buffy sides, and grey-mixed belly. Ears with a buffy tuft at their anterior bases, and a white one posteriorly. Hands and feet white. Tail brown above, whitish below. Mammæ, in three specimens, fourteen in number, arranged 5—2=14, but the gap between the thoracic and inguinal pairs is not great.

Skull about as in *venustus*, the supraorbital ridges well developed.

Dimensions of the type:—

Head and body 124 mm.; tail 90; hind foot 21; ear 18.

Skull: greatest length 29; condylo-incisive length 26·8; zygomatic breadth 15·5; nasals 12·3; interorbital breadth 4·7; palatilar length 13; palatal foramina 6·9; upper molars 4·6.

*Hab.* Tarija Department of S. Bolivia. Type from Tablada, 2000 m.

*Type.* Old female. B.M. no. 26. 1. 1. 33. Original number 1825. Collected 21st December, 1924.

This species, by size and colour, is like *H. venustus*, but that animal, as shown now by a considerable number of



examples, has only  $3-2=10$  mammæ, while three examples of the present form all have  $5-2=14$ . This number is also found in the Salta *musculus*, which is, however, much smaller, being apparently a member of the *laucha* group.

8. *Hesperomys murillus cordovens*, Thos.

♂. 1838. Tablada, 2000 m.

♂. 1917. Sama, 4000 m.

Female specimens showing the mammæ will be needed before this determination can be looked upon as satisfactory.

9. *Neotomys vultur*, Thos.

♂. 1923, 1926, 1965 ; ♀. 1956, 1984. Sama, 4000 m.

Quite similar to the Jujuy *vultur*, and similarly with longer tail than in *ebriosus*. The largest specimen, female, measures—head and body 128 mm.; tail 88; hind foot 22.5.

The occurrence of these rare marsh-rats in S. Bolivia tends to bridge the wide gap between Jujuy and Peru, the only localities hitherto recorded for the genus. Mr. Shipton has also recently sent us specimens from Aconquija, Catamarca, at 4000 m.

10. *Akodon tartareus*, Thos.

♂. 1810, 1814, 1818, 1819, 1824, 1832 ; ♀. 1803, 1817. Tablada, 2000 m.

♂. 1884, 1886, 1892, 1893, 1895, 1897, 1899, 1901, 1903, 1905, 1907, 1910, 1912, 1913, 1916, 1917, 1921 ; ♀. 1896, 1898, 1900, 1902, 1906, 1914. Carlazo, 2300 m.

Only previously known from the single specimen obtained by Sr. Budin in 1918 at Tartagal, Salta, so that this good series is particularly welcome.

Fortunately, a number of the specimens are quite young, and I am able to record that in these no trace of the anterior groove on  $m^1$  is perceptible.

In this difficult Akodont group young specimens are of the greatest value as showing the structure, when unworn, of  $m^1$ , and the series, both of this species and of *A. pacificus*, will be most helpful in the further working out of the genus.

11. *Akodon sylvanus*, Thos.

♂. 1857. Pino, 1800 m.

This single specimen agrees closely with the typical series of *sylvanus* from the Sierra Santa Barbara, Jujuy, being

equally smaller than the large *A. s. pervalens* obtained by Sr. Budin at Carapari, S. Bolivia, a somewhat unnatural distribution. Very likely *pervalens* will prove to be quite distinct from *sylvanus*, and nearer to *tartareus*, with which it agrees in size, but the supraorbital ridges are less marked. A satisfactory opinion on the subject will only be reached when young specimens of *pervalens* are available for study of the structure of  $m^1$ . True *sylvanus* has a complicated  $m^1$ , with well-marked anterior groove, and is therefore essentially different from *tartareus*.

12. *Akodon pacificus*, Thos.

♂. 1863. Pino, 1700 m.

♂. 1894; ♀. 1915. Carlazo, 2200 m.

♂. 1925, 1935, 1951, 1952, 1954, 1966, 1968, 1970, 1981; ♀. 1967. Sama, 4000 m.

In this species  $m^1$  has a well-marked groove on its anterior surface.

13. *Bolomys albiventer*, Thos.

♂. 1932, 1937, 1939, 1940, 1941, 1946, 1947, 1949;  
♀. 1938, 1944, 1948, 1964. Sama, 4000 m.

No. 1941 is quite young, and shows that this animal has a notch on  $m^1$  in youth. When I wrote a revision of the Akodont genera in 1916 young specimens were not available.

14. *Oxymycterus paramensis jacentior*, Thos.

♂. 1859 (yg.), 1861 (yg.), 1864, 1866; ♀. 1858. Pino, Tarija, Bolivia, 1800 m.

15. *Abrocoma cinerea*, Thos.

♂. 1950, 1953, 1955, 1963, 1985 (young), 1988; ♀. 1931, 1943, 1945, 1959, 1989. Sama, 4000 m.

The first record of the genus *Abrocoma* in Bolivia. A very fine series, of which the largest skull is 52 mm. in length. One of those from the Sierra de Zenta, Jujuy, has, however, a length of 51.4 mm.

16. *Ctenomys lewisi*, sp. n.

♂. 1969, 1975, 1977, 1979, 1980, 1982; ♀. 1971, 1972, 1973, 1974, 1976, 1978, 1994, and three separate skulls. Sama, 4000 m.

A large reddish-brown species with unusually proodont incisors.

Size large, the skull long, but not very bulky. General colour above uniform dark cinnamon-brown without special markings, the muzzle slightly washed with blackish. Under surface brighter cinnamon, often very bright, sometimes throughout, and always in the inguinal region. Throat generally with a slight indication of a darker collar. Hands and feet dull whitish. Tail very thinly haired, its base above blackish, the rest whitish.

Skull large, of considerable length, but neither so broad and robust as in *C. boliviensis*, *C. tuconax*, and their allies, or so narrow as in the large southern species, *C. fodax*, *fuliginus*, and others. Nasals rather short and broad. Interorbital region broad, without projecting supraorbital ledges. Lambdoid crest strongly developed, with well-marked median forwardly directed angle. Zygoma with simple angular projection above, not broadened at its tip; no concave groove on the outer upper side of the malar. Bullæ somewhat compressed.

Incisors very large and heavy, flattened and strongly pigmented in front, very proodont, as much as in the otherwise very different *C. leucodon*, the incisive angle in the type no less than  $117^{\circ}$ . From above they are visible in front of the premaxilla for 7–8 mm. They are also remarkable for their great breadth, the combined width of the two in the type 9.2 mm., as compared with 7 in *leucodon*. Cheek-teeth as usual,  $p^4$  not especially enlarged.

Dimensions of the type, and of an old female with closed basilar suture:—

Head and body 219, 204 mm.; tail 68, 71; hind foot 37, 37.

Skull: greatest length 52, 50; condylo-incisive length 54, 51.5; zygomatic breadth 33, 31; nasals  $17 \times 9.5$ ,  $17 \times 8.8$ ; interorbital breadth 18.5, 12.8; mastoid breadth 29.5, 29.2; breadth across muzzle 14, 12.8; palatilar length 25.8, 25; combined breadth of incisors 9, 8; oblique diameter of  $p^4$  4.4, 4.6.

*Hab.* as above.

*Type.* Young adult male, the skull fully developed, but the basilar suture still open. B.M. no. 26. 1. 1. 116. Original number 1979. Collected 7th March, 1925.

This handsome tuco-tuco is one of the finest members of the genus, and I have much pleasure in connecting with it the name of Mr. Lewis, to whose generosity we owe the continuation of Señor Budin's fruitful exploration. Its

large size and striking cinnamon colour are very noteworthy, and it is especially remarkable for the unusual, and, with one exception, unique proodonty of its incisors, and their unusual breadth. The one exception is *C. leucodon*, which has similarly proodont incisors, but these are comparatively slender, are not so strongly flattened in front, and are almost unpigmented. Probably the two species are not really very closely related.

Señor Budin was much struck by the semi-aquatic habits of this species, of which he says :—

“This magnificent Tuco-Tuco, which I have called ‘Tojo naranjado,’ is very peculiar because it lives on the banks of the streams, its holes being often within a foot of the water’s edge. At times I have found that they make their holes in the mud, and at the bottom of these holes there is water, in which I have placed traps and caught specimens. This would indicate that the species lives almost entirely in the water. They make their galleries in the banks, and if these are sought in other directions where the soil is dry, none are to be found.”

17. *Ctenomys sylvanus mordosus*, subsp. n.

♂. 1852, 1853 (young), 1854 (young); ♀. 1851, 1855, 1856. Melocoton, 1700 m.

♂. 1868, 1878, 1876; ♀. 1869, 1870, 1871, 1872, 1874, 1875. Tambo, 2200 m.

Size and general external appearance quite as in true *sylvanus*; colour varying from dark drabby-brown, with blackish face and crown, to chestnut or russet-brown, with the head scarcely darker. Under surface with drab or dark russet, whitish axillary patches only exceptionally present.

Skull like that of *sylvanus*, with the same general proportions and the same medium-sized bullæ, or these may average a little smaller. But the incisors are much broader and heavier, their combined breadth attaining 7 mm. in old specimens as compared with 5.5 mm. in equally aged specimens of *sylvanus*. In correlation with this, and perceptible even in immature examples, the muzzle is swollen and thickened laterally on each side of the anterior fourth of the nasals, so that a transverse measurement of 11 mm. will be surpassed by the bone in *mordosus*, while freely clearing the rostrum in *sylvanus*. This thickening of the bone of the rostrum is of a similar nature to that found to a still greater extent in *C. boliviensis*, and is clearly a definite character of the animal.

Incisors fairly orthodont, index of type 98°, very different from the unusually proodont incisors of the last species.

Dimensions of the type :—

Head and body 194 mm. ; tail 74 ; hind foot 31·5.

Skull : greatest length 46 ; condylo-incisive length 46 ; zygomatic breadth 29·5 ; nasals 16·7 × 9 ; interorbital breadth 11·5 ; mastoid breadth 27 ; breadth across muzzle 13 ; palatilar length 21 ; combined breadth of incisors 7 ; oblique diameter of  $p^4$  4·5.

*Hab.* Tarija Department. Type from Tambo, 2200 m.

*Type.* Adult male. B.M. no. 26. 1. 1. 132. Original number 1873. Collected 14th February, 1925.

It is interesting to find this local race of *C. sylvanus* showing a tendency towards the thickening of the incisors and rostrum which becomes so exaggerated in the more northern *C. boliviensis* and *steinbachi*.

An allied species, with equally broad incisors, is the *Ctenomys frater* of Potosi, but that has peculiarly narrowed bullæ and is of a decidedly lighter colour.

Sr. Budin says of this species : "They are very scarce, as I have only been able to find five colonies of them, and it is very difficult to catch more than one specimen from a colony ; this is generally the case with all Tuco-tucos, on account of their intelligence, mobility, and cunning. They make their burrows on the slopes of the ravines in the forest, where the ground is covered with tangled scrubs and undergrowth, which makes it hard to locate their peculiar little mounds. None of the burrows that I discovered were on the flat, but were on almost perpendicular declivities, in very humid, almost muddy soil."

#### 18. *Lagidium vulcani*, Thos.

♂, 1878 ; ♀, 1879, 1880, 1881, 1882. Tambo, 3000 m.

♂, 1927 ; ♀, 1922, 1924, 1993. Sama, 4000 m.

The occurrence of this vizcacha here was quite to be expected, as the range of mountains that runs through Jujuy seems to be more or less continuous with that on which Sr. Budin obtained them. Such an excellent series is of the greatest value in mapping the distribution of the genus, and Sr. Budin's observation that this is the farthest eastern occurrence of vizcachas in Bolivia is an important contribution to our knowledge of the subject.

"From the crest of the Sierra del Condor, about 1000 metres above Tambo ; these are the last to be found towards the East."—*E. B.*

19. *Galea musteloides*, Meyen.

♂. 1808, 1811, 1813, 1820, 1829, 1831, 1833, 1834, 1835, 1846; ♀. 1816, 1839, 1840, 1841, 1848. Tablada, 2000 m.

♂. 1883, 1920; ♀. 1908. Carlazo, 2300 m.

♂. 1942, 1958, 1990. Sama, 4000 m.

In view of the variability of both colour and skull in this group of caviés, I am now prepared to consider with Mr. Osgood\* that they should all be referred to *musteloides*, from which I should no longer distinguish Waterhouse's *boliviensis* or the Jujuy form I described as *G. comes*.

20. *Didelphis paraguayensis*, Oken.

♂. 1911; ♀. 1918. Carlazo, 2300 m.

21. *Marmosa janetta*, sp. n.

♂. 1804, 1805, 1812, 1815; ♀. 1809. Tablada, 2000 m.

♀. 1860. Pino, 1700 m.

♂. 1885, 1888, 1890, 1891; ♀. 1887, 1919. Carlazo, 2300'.

Related to *M. verax* of the Paraguayan Chaco, but with the hairs of the sides of the belly more or less slaty at base, thus rendering the separating line between the colours of the upper and lower surfaces much less sharply defined.

Size, as gauged by skull, larger than in any of the Bolivian and N. Argentina forms of *M. elegans*, and slightly exceeding that of the chaco *M. verax*. Colour-pattern as usual in the group, the dark drabby dorsal area well defined from the lighter drabby flanks, the crown darker, the face-markings well defined, and the usual dark patch present on the shoulders. Under surface creamy white, the hairs on the throat and chest white to their bases, while those of the belly, either throughout or at least along its sides, are broadly slaty at base. As a consequence, the lateral line of demarcation is vague and not sharply defined, in marked distinction from that of *M. verax*, in which it is straight and sharply contrasted; chest-gland well developed in all male specimens. Hands and feet white. Tail longer than in Bolivian forms of *elegans*, grey above and white below. Mammæ in one specimen numbering no less than seven lateral pairs.

Skull, in all adult specimens, with quite well-defined thread-like supraorbital beads, the presence of these distinguishing the Paraguayan comadreas from all the forms of *elegans*, as

\* Field Mus. Publ. x. p. 210 (1910).

pointed out in 1902\*. The beads run along the frontals to the parietal suture, but do not trespass on to the latter bone, where their continuation can only be traced as a faint ridge; in the type of *verax*, a very old specimen, they are only about half as long. General shape of skull narrow, with long muzzle, the zygomata not very widely expanded. Bullæ about as in *verax*.

Dimensions of the type :—

Head and body 125 mm.; tail 137; hind foot 15·7; ear 25.

Skull: greatest length 32; condylo-basal length 31·2; zygomatic breadth 18; nasal  $14 \times 3$ ; interorbital breadth 5; breadth of brain-case 11·2; combined length of  $m^{1-3}$  5·2.

*Hab.* Tarija region of S. Bolivia. Type from Carlazo, 2300 m.

*Type.* Old male. B.M. no. 26. 1. 1. 167. Original number 1888. Collected 26th February, 1925.

A most interesting and valuable series as tending to throw light on the difficult problem of the relationship of the Paraguayan and Andean opossums to each other.

The good series of skulls is particularly useful as indicating the constancy of the characters used.

#### XLVI.—*A Fossil Rice-rat from the Pleistocene of Barbuda.*

By ARTHUR T. HOPWOOD, M.Sc., F.L.S.

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[Plate XII.]

THE specimen described in the following note was collected by Prof. J. W. Gregory, F.R.S., some twenty-five years ago among some Pleistocene cave-breccia on the island of Barbuda, West Indies, and presented by him to the British Museum. It was studied by the late Dr. C. I. Forsyth Major, who pronounced it to belong to a new extinct species, which he proposed to name *Oryzomys audreyæ*, in honour of Mrs. Gregory. Unfortunately, Major took no further steps in the matter, except for the following passing reference:—“... the detailed description, with figures, of ... the lower dentition of a third (extinct) species, found by Prof. Gregory in a small ossiferous breccia of Barbuda, will be given in

\* Ann. & Mag. Nat. Hist. (7) x. p. 158 (1902).

another place" (Major, 1901, Ann. & Mag. Nat. Hist. ser. 7, vol. vii. p. 205). Relying on this reference, Trouessart founded his species *Oryzomys* (*Megalomys*) *majori* in 1904 (Trouessart, 1904, Cat. Mamm., Suppl. p. 415). This is not sufficient to make Trouessart's name valid; and, since *M. majori* has never been described or figured, the name remains a *nomen nudum*. It is proposed to adopt Major's original name for the species.

*Megalomys audreyæ*, sp. n.

*Oryzomys audreyæ*, Forsyth Major, MS.

*Oryzomys* sp. ext., Forsyth Major, loc. cit. *supra*.

*Megalomys majori*, Trouessart, loc. cit. *supra*.

**Material.**—Left mandibular ramus; holotype, in Brit. Mus. (Geol. Dept.), registered no. M 7406 *a*. Also an upper incisor-tooth; paratype, registered no. M 7406 *b*.

**Horizon.**—Pleistocene.

**Locality.**—Cave on the island of Barbuda, West Indies.

**Diagnosis.**—Lower incisor unknown, tubercle over root of tooth small. *M* 1 unknown. *M* 2, tooth nearly square; crown low; protoconulid slight, mesostylid and entostylid well developed. *M* 3 somewhat trigonal; protoconulid slight, mesostylid strong, and apparently a trace of an entostylid. Paraconid apparently absent from both *M* 2 and *M* 3.

**Measurements.**—

*M. audreyæ*, nov. *M. luciae*, Major.

	mm.	mm.
Diastema . . . . .	8.5	8.2
Molar series . . . . .	8.3	9.4
<i>M</i> 2+3 . . . . .	5.2	5.8

**Description and Remarks.**—The specimen is badly broken, the incisor, coronoid process, condyle, and angle of the jaw are all lost, as also is the first molar tooth. The remaining teeth compare very closely with those of the type-specimen of *M. luciae*, except in size. They have the four main cusps (proto-, meta-, hypo-, and entoconid) strongly developed, with much smaller and relatively weak accessory cusps. The protoconulids are recognizable as small enamel folds on the antero-external angles of the teeth. So far as may be seen, the paraconids are not present, though it is possible that a slight dilatation of the enamel figure on the antero-internal angles may represent the worn bases of this structure. In *M. luciae* there is a definite paraconid. Both species have well-developed mesostylids and entostylids in the second



molar, together with a strong mesostylid in the third molar. This latter tooth has a slight dimple in the enamel of the hypoconid in *M. audreyæ*, which, in *M. lucia*, is more strongly marked to make an incipient fold. Probably this represents an entostylid.

The upper incisor-tooth shown on the Plate is referred to the species under discussion. It occurred in the same fragment of breccia as the type, and is clearly the tooth of a *Megalomys*.

In conclusion, I wish to express my thanks to Prof. Gregory for calling my attention to this very interesting specimen, and to Mr. Oldfield Thomas, F.R.S., for his advice and for the loan of the type-skull of *M. lucia*.

#### EXPLANATION OF PLATE XII.

Fig. 1. *Megalomys audreyæ*, sp. n. Left ramus mandibulæ, seen from above.  $\times 5$ .

Fig. 2. Ditto. Upper incisor.  $\times 5$ .

Specimens in Brit. Mus. (Geol. Dept.), registered M 7406 *a* and *b*.

XLVII.—*Three Species of Lepidocyclines from Western India and Persia.* By W. L. F. NUTTALL, D.F.C., M.A., F.G.S., The Sedgwick Museum, Cambridge.

[Plate XIII.]

#### INTRODUCTION.

The following paper includes palæontological descriptions of three species of Orbitoides of the genus *Lepidocyclina*, which in India is restricted to Oligocene and Miocene strata. These Foraminifera are found in Sind, and along the Baluchistan Border of Western India. Two of the species (*L. dilatata*, Michelotti, and *L. sp.*) occur in the Oligocene Nari Series, and one (*L. blanfordi*, sp. n.) in the Miocene Gaj Series. One of the above species, *L. dilatata*, a form common in Europe, is also described from South-western Persia, where it is found in the lower part of the Asmari Limestone, the basal portion of which is Oligocene in age.

The author wishes to make the following acknowledgments: the majority of the specimens examined consist of material generously loaned by the Indian Geological Survey.

The directors of the Whitehall Petroleum Corporation have kindly granted the author permission to make use of the specimens he collected during a geological reconnaissance undertaken on their behalf. The directors of the Anglo-Persian Oil Company have also loaned specimens collected by Mr. R. K. Richardson in South-west Persia.

*Lepidocyclus (Eulepidina) dilatata* (Michelotti).

(Pl. XIII. figs. 1-4; text-fig. 1.)

1853. *Orbitolites* sp., Carter, H. J., Ann. & Mag. Nat. Hist. ser. 2, vol. xi. pp. 175-6, pl. vii. figs. 40-41.  
 1861. *Orbitoides dilatata*, Michelotti, G., Nat. Verh. Holland, Maat. Wet. Haarlem, ser. 2, vol. xv. p. 17, pl. i. figs. 1-2.  
 1861. *Orbitolites* sp., Carter, H. J., Ann. & Mag. Nat. Hist. ser. 3, vol. viii. pp. 455-6.  
 1870. *Orbitoides pupyracea*, Boubée (also called *O. fortisi*, D'Arch.), pars Blanford, W. T., Mem. Geol. Surv. Ind. vol. xvii. pp. 50-3; Fedden, F., idem. p. 199.  
 1906. *Lepidocyclus dilatata* (Michelotti), Vredenburg, E. W., Rec. Geol. Surv. Ind. vol. xxxiv. p. 91.  
 1910. *Lepidocyclus dilatata* (Michelotti), Silvestri, A., Mem. Nuovi Lincei Pontif. Acr. vol. xxviii. pp. 139-156, text-figs. xxv. 9 a-c, pl. i. figs. 2-10.  
 1924. *Lepidocyclus dilatata* (Michelotti), Douglas, J. A., in Richardson, R. K., Journ. Inst. Pet. Techn. vol. 10, no. 43, table no. 2 opp. p. 14.  
 1924. *Eulepidina dilatata* (Michelotti), Douvillé, H., Mém. Soc. Géol. France, n.s. vol. i. Mém. no. 2, p. 48, pl. ii. fig. 3.  
 1925. *Eulepidina dilatata* (Michelotti), Douvillé, H., Mem. Soc. Géol. France, n.s. vol. ii. Fasc. iii. Mem. no. 2, pp. 71-3, pl. iv. figs. 1-4, pl. v. figs. 1-4 and references.

*Previous References.*—This species appears to have been first recorded from Sind by Carter in 1853, who gave it no specific name. To judge from his figures, and the reported association of the species with *Nummulites sublaevigatus* (= *intermedius*, D'Arch.) (see Carter, 1861), there is little doubt that it is *L. dilatata* \*.

Vredenburg was the first to recognize that the common Nari *Orbitoides* of Western India all belonged to one species, *L. dilatata*. Specimens from this region have, however, never been adequately described nor compared with typical European representatives of the species.

\* In 1853, Carter (*loc. cit.* pp. 174-5, pl. vii. figs. 32-34) described another species of Orbitoid from Sind. This was incorrectly referred to "*Orbitoides*" *mantelli* (Morton), a well-known form that has so far not been found outside America, and has been classified by Prof. H. Douvillé (*loc. cit.* 1924, p. 37) as an *Isolepidina*. Carter's description is inadequate, and it is not certain whether the specimens he examined were *Discocyclus* or *Lepidocyclus*.

Dr. J. A. Douglas has recently identified the same species for the first time from Persia. I can distinguish no difference whatever between the specimens from Persia and Western India, and the palæontological descriptions below are based upon forms from both regions.

*Material.*—I have examined 75 specimens of this species from the Nari Series of Western India. The tests are usually found disengaged from the rock matrix with their borders broken. They also occur imbedded in a soft yellow limestone, some bands being nearly entirely made up of the tests of microspheric individuals, the megalospheric form being rare. The material from Persia is a hard compact limestone from which microscopic slides have been prepared. The detailed structure is, on the whole, better preserved in this limestone than in specimens from India. Also in the Persian limestone the microspheric and megalospheric forms appear to be equally common. In both regions *L. dilatata* is found associated with *Nummulites intermedius*, D'Arch.

*Description—Microspheric Form.*—Test circular in outline, wavy, rarely saddle-shaped, thin and lenticular. Maximum observed diameter 4 to 5 cm. Test thickest at the centre, occasionally with a small ill-defined boss, and decreasing gradually in thickness towards the periphery. Maximum observed thickness at the centre 5 mm., average thickness at the centre 2·5 mm. Border sharp, the thickness of the test at the periphery being about 0·5 mm. Exterior surface smooth or slightly granular. The structure of the lateral chamber-layer is not clearly shown on the outer surface, and can only be observed satisfactorily by cutting a tangential section.

In equatorial section (Pl. XIII. fig. 8) the chamberlets of the median layer are hexagonal to spatuliform. Near the periphery their average length is 0·15 mm., and average width 0·1 mm. In transverse section (Pl. XIII. fig. 1) the width of the median chamber-layer near the centre of the test varies from 70 to 75  $\mu$ , and increases gradually in width towards the periphery, where it ranges from 170 to 190  $\mu$ . In a more magnified portion of a transverse section (Pl. XIII. fig. 4) it may be seen that the septa of the chamberlets of the median layer are convex exteriorly, and their outer surface appears crenulate, the septa being perforated by fine lateral canals.

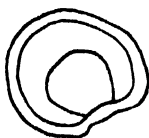
In a tangential section (Pl. XIII. fig. 2) the lateral chambers are completely surrounded by septa, which vary little in thickness (50 to 70  $\mu$ ). The chambers are very

irregularly subcircular or oval in cross-section, their diameter varying from 0.1 to 0.4 mm. At the junction of the septa small indistinct columus are usually present.

**Megalospheric Form.**—The megalospheric form possesses a much smaller test than the microspheric, the maximum observed diameter being 1.5 cm. The megalosphere (text-fig. 1) is of the typical Eulepidine type. The diameter of the outer chamber varies from 1.8 to 1.5 mm., that of the inner chamber 0.85 to 0.7 mm. The bounding lamina of the outer chamber attains a thickness of  $190\ \mu$ , the wall of the inner chamber being about  $20\ \mu$ .

**Comparison with European Forms and Age of the Beds.**—The European representatives of this species have been the subject of a careful study by Prof. H. Douvillé (*l. c.* 1925). He has included under *L. dilatata* forms showing considerable variation in the structure of the lateral chamber-layer. The characteristic structure is found in specimens from the

Text-fig. 1.



*Lepidocyclus (Eulepidina) dilatata*, Michelotti.  $\times 10$ .

Equatorial section of nucleococonch of the megalospheric form;  
from the same locality as Pl. XIII. fig. 3.

type-locality of Molere in Northern Italy, and in others from Peyrère in South-western France. In the lateral chamber-layer there are large distinct pillars and polygonal chambers. In one variety illustrated by Douvillé (*l. c.* 1925, pl. v. fig. 4), however, the septa completely surround the chambers as in the Indian forms. I have also compared the Indian variety with specimens from Trinidad, which were referred to *L. dilatata* by Douvillé (1924), and find the structure of the lateral chamber-layer in these two cases practically identical. The lateral chamber-layer of the Indian variety is distinguished from that of the typical European form by the small size of the pillars and by the septa completely surrounding the chambers of the lateral layer.

According to Douvillé's classification of the marine Neogene of the Orient (*l. c.* 1925, p. 84), strata equivalent

in age to the Stampian of Europe are characterized by *Eulepidina* and reticulate *Nummulites*. The Nari Series of Western India and the lower portion of the Asmari Limestone of part of South-west Persia both contain *Eulepidina dilatata* and *Nummulites intermedius*, and may be considered to be of this age.

*Occurrence.* From the following localities in the Nari Series of Sind and the Baluchistan Border:—

- (a) E. of Sari, Thana Bula Khan Taluqa, Coll. W.L.F.N.
- (b) Near Khand Jhaud, Karachi Taluqa, Coll. W.L.F.N.
- (c) E. of Limestone Ridge, 8 miles N.E. of Jungshahi, Indian Geological Survey. No. G. 226/57. Coll. Fedden.
- (d) E. of Trak, Kohistan, I.G.S. No. G. 226/58. Coll. Fedden.
- (e) Hindi Hill, N. of Trak, Kohistan, I.G.S. No. G. 226/59. Coll. Fedden.
- (f) Gaj River, N.W. of Sehwan, I.G.S. No. 226/60. Coll. Fedden.
- (g) Charlo, S. of Sehwan, I.G.S. No. G. 226/78. Coll. Fedden.
- (h) E. of Trak Hill, N. of river, Kohistan, I.G.S. No. G. 280/52. Coll. Fedden.
- (i) Vale S. of Trak Camp, Kohistan, I.G.S. No. G. 280/53. Coll. Fedden.
- (j) Scarp of Kotar Range, W. of Damach, I.G.S. No. G. 302/61. Coll. Ram. Singh.
- (k) W. of Damach, Thana Bula Khan Taluqa, I.G.S. No. G. 302/71. Coll. Fedden.
- (l) Beynir Hill, 10 miles E. of Thana Shah Beg, I.G.S. No. G. 302/82. Coll. Fedden.
- (m) Between Baili and Khand, Habb Valley, I.G.S. No. G. 304/19. Coll. Hira Lal.
- (n) Small Hill W. of Nal, Baluchistan, I.G.S. No. K. 10/319. Coll. Tipper.
- (o) 10 miles W. of Naka (Hindian), W. of Mol Plateau, Baluchistan, I.G.S. No. K. 10/429. Coll. Tipper.

From the base of the Asmari Limestone Bard-I-Qamcheh, S.W. Persia. Coll. R. K. Richardson.

*Lepidocyclina blanfordi*, sp. n.  
(Pl. XIII. figs. 5, 6, 9, 10.)

*Description.*—Test globose-lenticular, with a wide boss on either side. Diameter of the test attains a maximum of 24 mm.; diameter of boss about 10 mm. Thickness of test 6 to 10 mm. at the centre and about 1.5 mm. near the periphery. Surface covered with circular indentations representing the lateral chambers, which are of greatest diameter at the centre of the boss.

In an equatorial section the form is observed to be microspheric. The chamberlets of the median layer near the centre are oval to hexagonal with their longer axes parallel to the circumference (Pl. XIII. fig. 5). At a point

about 1.2 mm. from the centre their length (parallel to the radius) is  $60\ \mu$  and their width (parallel to the circumference)  $80\ \mu$ . Near the periphery the chamberlets are hexagonal or spatuliform, their length attaining  $220\ \mu$  and their width  $160\ \mu$ . In a transverse section the height of the lateral chambers varies little from the centre towards the upper surface. It is from 80 to  $110\ \mu$ . The width of the median chamber-layer increases gradually from the centre ( $60\ \mu$ ) to the periphery ( $140\ \mu$ ).

In a tangential section cut immediately above the median chamber-layer (Pl. XIII. fig. 9) for a distance of 1.7 mm. from the centre the lateral columnar chambers are narrow, the surrounding shell-substance being thick. Towards the periphery the lateral chambers are irregular in shape, being subcircular to elongate-oval in cross-section. Their diameter attains a maximum of  $650\ \mu$ ; their average diameter is about  $250\ \mu$ ; their smallest diameter about  $100\ \mu$ . They are completely surrounded by septa with a width of 40 to  $100\ \mu$ . In a tangential section cut through the centre of the boss, a short distance beneath the upper surface (Pl. XIII. fig. 10), the width of the lateral chambers is 200 to  $400\ \mu$  and the thickness of the surrounding septa 100 to  $400\ \mu$ .

*Related Forms.*—This species belongs to a group of Lepidocyclines, characterized by the absence of pillars in the lateral chamber-layer. In a recent paper on the Lepidocyclines of Christmas Island\*, I have given a list of the species of this type found in the Orient. *L. blanfordi* has a different structure of the lateral chamber-layer to any of these. It is primarily distinguished by the closer proximity of the lateral chambers as seen in a tangential section cut near the median layer. Also near the upper surface at the centre of the test the septa attain a great width. The European species it resembles most is *L. formosoides*, Douvillé†. Since the megalospheric form of *L. blanfordi* is unknown, it is at present uncertain whether it should be placed in the subgenus *Eulepidina* or *Amphilepidina*.

In 1861, Carter‡ described as *Orbitolites mantelli* a small megalospheric Lepidocycline without columns in the lateral layer. This is the only other species of this type described from Sind.

*Material and Occurrence.*—I have been able to examine

\* Q. J. G. S. vol. lxxxi. 1926 (in the press).

† Douvillé, H., Mém. Soc. Géol. France, n.s. vol. i. Mém. No. 2, 1924, p. 71.

‡ Carter, H. J., Ann. & Mag. Nat. Hist. ser. 3, vol. viii. pp. 329-31, pl. xvi. figs. 2 a-i, pl. xvii. figs. 2 n-o.

only four specimens of this species, from three of which microscopic slides have been prepared. The specimens were collected from the Gaj Series (classified by Vredenburg as Aquitanian and Burdigalian) from "a few miles south of Pirmanjal, north of Karachi, Sind," Indian Geological Survey, No. G. 302/51. This species is named in honour of the late W. T. Blanford, who was the first to make a geological survey of Sind.

*Lepidocyclina* sp. (Pl. XIII. figs. 7, 8 ; text-fig. 2.)

*Material*.—There is only one specimen of this species, and it merits attention, since it is the first *Lepidocyclina* recorded from Western India with large pillars in the lateral chamber-layer. This specimen was found in the Nari Limestone together with *L. dilatata*. The locality from which it was collected was "Scarp of Kotar Range",

Text-fig. 2.



*Lepidocyclina* sp.  $\times 10$ .

Tangential section ; part of same specimen  
figured in Pl. XIII. fig. 7.

W. of Damach, Karachi District, Sind"; Indian Geological Survey, registered No. G. 302/61.

*Description*.—Test globose; diameter 3.4 mm.; thickness 2.1 mm. Pl. XIII. fig. 7 shows a polished surface of the test cut tangentially a short distance below the upper surface, and the structure in this section is also shown in text-fig. 2. There are about 30 large subcircular pillars with a diameter of 0.15 to 0.30 mm., each surrounded by from 11 to 13 radiate septa. The average distance between the exterior of adjoining columns is about 0.15 mm., and not over 0.20 mm.

Pl. XIII. fig. 8 illustrates part of a polished surface of an equatorial section of the same specimen. In this section the form was seen to be megalospheric, but the details of the nucleoconch were not shown. The shape of the median chamberlets is hexagonal with rounded angles. Their

average diameter near the periphery of the test is about 0.05 mm. and their average width about 0.04 mm.

*Remarks.*—The single specimen of this species gives insufficient data for accurate determination. The form it resembles most is the European *L. præmarginata*, R. Douvillé\*, the structure of the lateral chambers being nearly identical in the two species. It differs, however, from this species by being megalospheric, and having hexagonal instead of lozenge-shaped chambers in the median layer.

#### EXPLANATION OF PLATE XIII.

- Fig. 1.* *Lepidocyclus (Eulepidina) dilatata* (Michelotti). Transverse section. From the Nari Limestone of near Khand Jhand, Karachi District, Sind.  $\times 5$ .
- Fig. 2.* Ditto. Tangential section; same locality as fig. 1.  $\times 20$ .
- Fig. 3.* Ditto. Equatorial section; from the base of the Asmari Limestone, Bard-I-Qamcheh, S.W. Persia.  $\times 20$ .
- Fig. 4.* Ditto. Portion of transverse section; same locality as fig. 3.  $\times 20$ .
- Fig. 5.* *Lepidocyclus blanfordi*, sp. n. Equatorial section; from the Gaj Series "a few miles S. of Pir Manjal, north of Karachi, Sind."  $\times 10$ .
- Fig. 6.* Ditto. View of exterior. Holotype.  $\times 2$ .
- Fig. 7.* *Lepidocyclus* sp. Polished surface of the test cut tangentially near the upper surface; from the Nari Series of "Scarp of Kotar Range, W. of Damach, Karachi District, Sind."  $\times 10$ .
- Fig. 8.* Ditto. Polished surface of same specimen as in fig. 7, cut equatorially.  $\times 20$ .
- Fig. 9.* *Lepidocyclus blanfordi*, sp. n. Tangential section cut near the median chamber-layer.  $\times 10$ .
- Fig. 10.* Ditto. Tangential section cut at the centre near the upper surface of the boss.  $\times 10$ .

**XLVIII.**—*Brachyodus woodi*, a new Species from the Hempstead Beds. By C. FORSTER COOPER, M.A., Superintendent of the University Museum of Zoology, Cambridge.

[Plates XIV. & XV.]

IN a recent paper † on the species of the genus *Ancodon* from the Hempstead Beds, I added some notes on those of the genus *Brachyodus* from the same locality.

Concerning *B. porcinus* I there stated ‡ that this species

\* Douvillé, R., Bull. Soc. Géol. France, ser. 4, vol. viii. 1908, p. 91, figs. 1 & 4 a; Douvillé, H., Mém. Géol. Soc. France, n.s. vol. ii. Fasc. iii. Mém. no. 2, 1925, pp. 77-8, pl. vi. figs. 5-7.

† Ann. & Mag. Nat. Hist. ser. 9, vol. xvi. p. 113 (July 1925).

‡ Loc. cit. p. 135.



may be regarded as separate from *B. borbonicus*, but that, in these beds, *B. porcinus* showed a great variation in size.

Having now had the opportunity of examining further specimens of the true *B. borbonicus* and of *Anthracotherium minus*\*, I am able to clear up some points which were previously left rather obscure, and to describe some of the specimens as belonging to a new form.

#### THE LOWER MOLARS OF *BRACHYODUS* AND *MICROBUNODON*.

Lydekker has stated that there is no difference in the structure of the lower molars of these two genera. A comparison, however, of a lower molar of an undoubted *Microbunodon minus* with the smaller forms of the genus *Brachyodus* brings out the following point. In all specimens of *Brachyodus* with which I am acquainted the posterior ridge of the hypoconid and the postero-internal of the four ridges of the entoconid join one another, so that the valley is closed at the posterior end of the tooth (text-fig. 1 A). In the genera *Anthracotherium* and *Microbunodon* these ridges do not join, so that the valley remains open (text-fig. 1 B)†. If this is a constant generic difference, as it appears to be, there is here a character which serves to differentiate the lower molars of these genera, and the teeth described by Lydekker‡ as *Anthracotherium (Microbunodon) minus* are not correctly so determined, but belong to the genus *Brachyodus*.

#### THE SPECIFIC DIFFERENCE BETWEEN *B. PORCINUS* AND *B. BORBONICUS*.

A comparison of several specimens of *B. borbonicus* from St. André near Marseilles with specimens from the Hempstead Beds attributed to *B. porcinus* shows that some of the latter approach *B. borbonicus* so closely in size as to be indistinguishable in that respect. Moreover, various published figures§ of forms attributed to *B. porcinus* are in agreement

\* As a result of the paper just quoted I have been in communication with Dr. Stehlin upon *Anthracotheres* generally. I acknowledge with great pleasure my indebtedness to Dr. Stehlin for his ready assistance with specimens and casts for examination and comparison, as well as for some valuable comments.

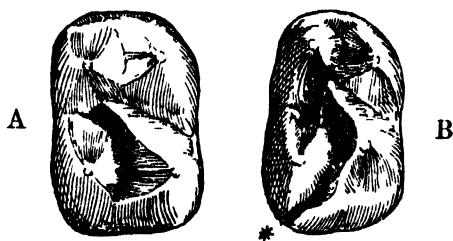
† For a terminology of the different parts of the upper and lower molar, see Forster Cooper, "Memoir on the Anthracotheriidae of the Bugti Hills," Mem. Geol. Surv. India, no. 2, 1924, pl. vii.

‡ B.M. Cat. Fossil Mammalia, part ii. p. 242.

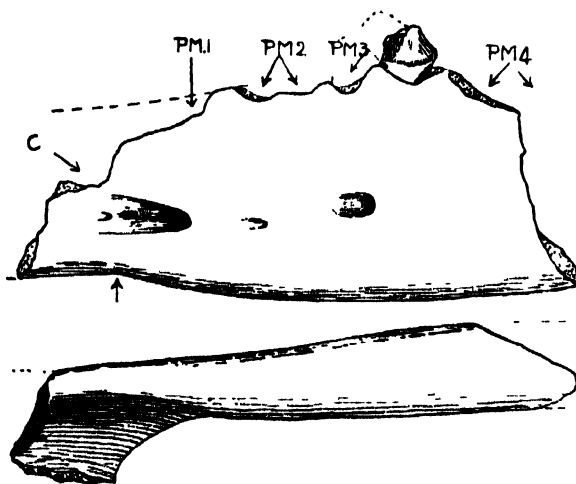
§ E. g., Depéret and Dauxami, "Les Vertébrés Oligocènes de Pyramont Challonges," Mém. Soc. Pal. Suisse, 1902, pl. v. fig. 14.

with this statement. There is, however, one point of difference in that the cusps of the teeth are perceptibly lower in *B. porcinus* than they are in *B. borbonicus*. The teeth

Text-fig. 1.



Text-fig. 2.



Text-fig. 1.—Second lower molars of (A) *Brachyodus porcinus* and (B) *Microbunodon minus*,  $\times 2$ . \* points to the open valley mentioned in the text.

Text-fig. 2.—Fragment of lower jaw attributed to *Brachyodus woodi*. PM. 1 etc., sockets for the premolars; C—, the position of the canine socket. The lower arrow points to the level of the hind border of the symphysis.

mentioned above as being attributed by Lydekker to *Anthrocotherium minus* (for which species they are also too large)

have these low cusps and the closed valley, and without any doubt may be referred to *B. porcinus*. *Anthracotheium* (*Microbunodon*) *minus* therefore is not known to occur in the Hempstead Beds.

*Brachyodus woodi*\*, sp. n.

If *B. porcinus* is an animal approximately the same size as *B. borbonicus*, but differentiated by its lower cusps, there remain a number of specimens of a distinctly smaller form. These consist of fragments of upper and lower dentitions, milk-teeth, and a portion of a symphysis of a lower jaw which is referred to this species.

As in all species of the genus *Brachyodus*, there is little of essential difference in the pattern of the molar teeth between this form and the others, but, as compared with *B. porcinus*, the cusps are lower and the mesostyles of the upper molars are narrower and appear to point rather more backwardly. The parastyle is more prominent because of a distinct bay in the contour of the tooth along the border between the parastyle and mesostyle. The cingulum on the upper molars differs in the two species. In *B. woodi* it is comparatively the more strongly marked and is complete round the inner border of the protocone and incomplete round the metaconule. In *B. porcinus* the condition is exactly the reverse, being incomplete round the protocone and complete round the metaconule†. The lower teeth are typically *Brachyodine*, and, except for the difference in size, resemble those of *B. porcinus*.

A piece of a lower jaw (text-fig. 2) with a part of the third premolar and sockets for the first and second may be attributed to this species. It is characterized by an unusual hollowing of the ramus of the lower border along each side of the symphyseal line. In this it differs greatly from a symphysis already attributed to *B. porcinus*‡.

The type-specimen of this species is a maxilla already figured in this Journal§ showing the last premolar and the three molars of the left side. As compared with *B. porcinus*, besides those points of difference already noted, the present

\* Mr. S. L. Wood has collected a number of specimens belonging to this form.

† The figures on Pl. XIV. do not show this very clearly.

‡ Ann. & Mag. Nat. Hist., July 1925, p. 131, fig. 13.

§ Loc. cit. pl. v. This figure does not sufficiently bring out the difference in size between this specimen and those of *B. porcinus* (figs. 4 and 5 on the same plate). Fig. 2, also referred to *B. woodi*, is more correct in size.

form differs in the proportionate measurements of the teeth. The last premolar is of the same length as that of *B. porcinus*, but is of a lesser breadth. The first molar is approximately the same size, but the second and third molars are smaller.

*Measurements in millimetres of the Teeth of B. woodi.*

UPPER TEETH.								
	<i>Pm. 4.</i>		<i>M. 1.</i>		<i>M. 2.</i>		<i>M. 3.</i>	
	Length.	Breadth.	Length	Breadth.	Length.	Breadth.	Length.	Breadth.
Type-specimen (Sedgwick Museum).	10	13	14	15	17·5	18·5	18·5	21·5
British Museum (no. M. 29773).	Milk- 12	molar. 12	15	15	17	17	..	..
<i>B. porcinus.</i>								
Sedgwick Museum ..	10	15·5	14	15·5	19	21·5	22	23·5
LOWER TEETH.								
<i>B. woodi</i> .....	..	..	15	9	17	11	P	13
<i>B. porcinus</i> .....	..	..	..	..	19	13	..	15

POSTSCRIPT.—Since this account was sent to the press, Mr. Wood has sent me a third upper premolar which undoubtedly belongs to *B. woodi*. Like the rest it comes from the Hempstead Beds, and compared with *B. porcinus* is proportionally smaller and differs in outline, being more flat along the outer border and comparatively broader in the internal shelf. It helps to support the view that the two forms are specifically distinct.

EXPLANATION OF THE PLATES.

PLATE XIV.

Fig. 1. *Brachyodus woodi*. The last milk-molar and first two molars. British Museum, M. 29773.

Fig. 2. Ditto. First and second molars and fourth premolar erupting. Sedgwick Museum.

**Fig. 3.** *Brachyodus porcinus*. First and second molars. Sedgwick Museum.

**Fig. 4.** *Brachyodus borbonicus*.

All figures are of the natural size. The first three figured specimens are from the Hempstead Beds, the fourth is from St. André, near Marseilles. The type-specimen of *B. woodi* has already been figured in this Journal (vol. xvi. pl. v. fig. 3) as a small form of *B. porcinus*.

#### PLATE XV.

**Fig. 1.** *Brachyodus woodi*. First and second lower molars, crown view. Sedgwick Museum.

**Fig. 2.** Ditto. Second lower molar and anterior two-thirds of the third molar. Sedgwick Museum.

**Fig. 3.** *Brachyodus porcinus*. Second lower molar and anterior two-thirds of the third molar. This specimen is no. M. 29803 in the Catalogue of the British Museum, where it is named *Anthraco-therium minus* (the label notwithstanding).

**Fig. 4.** Side view of fig. 1.

**Fig. 5.** Side view of fig. 2.

**Fig. 6.** Side view of fig. 3.

**Fig. 7.** *Brachyodus borbonicus*. Side view of the lower molars of a specimen from St. André, near Marseilles. A comparison of figures 4-7 shows the difference in the height of the cusps; this is especially noticeable when *B. porcinus* and *B. borbonicus* are compared.

All the figures are of the natural size, and (except the last) all the specimens are from the Hempstead Beds.

#### XLIX.—*Daunophis langi*, gen. et sp. n. (Pliocene, Burma).

By W. E. SWINTON, B.Sc., F.L.S.

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#### [Plate XVI.]

THE Hunterian Museum of Glasgow University has recently received as a donation from H. F. Lang, Esq., of Rangoon, a remarkable specimen of a fossil snake. The fossil was obtained from the oil-shale exposed in a quarry at Tichara, near Mepale, on the eastern side of the Dawna Hills, South Burma. Prof. Gregory had already obtained a number of fossils from the same area, of which some mollusca (see Annandale (1924), Records Geol. Surv. Ind. vol. lv. pt. 2, pp. 97-104, 1923) and a new genus and species of fossil fish (Annandale & Hora (1925), Rec. Geol. Surv. Ind. vol. lvi. pt. 8, pp. 204-209, 1924) have already been described. The snake now to be described comes from a horizon just below that in which the fish was found, and slightly higher than the molluscan beds. The beds have been briefly referred to, and the arguments for their Pliocene age given, in a paper by Prof. Gregory (April,

1923, 'Geological Magazine,' vol. lx. p. 152), to which Mr. W. N. Edwards contributed an appendix on some fossil plants from the same locality.

The great interest of the specimen lies in the fact that practically the whole length of the snake can be made out, either by the preserved bony material or its impression. Unfortunately, the bony remains are so crushed that it is impossible to obtain a complete vertebra; and, where the vertebrae are missing, the matrix is too much weathered to permit of a cast being obtained which would be of any value. The superior surfaces of practically all the vertebrae are missing, which further complicates the study of the specimen. It has been possible, however, by careful development and casting of the vertebral features left, to obtain a more or less accurate idea of the general appearance and proportions of the vertebrae for comparison with fossil and recent forms. Since Owen's original investigation of the validity of the classification of fossil snakes by their vertebral characters (1850, 'Fossil Reptilia of the London Clay,' pt. 3, Ophidia, Palæontographical Society), vertebrae have been largely used for diagnostic purposes, and the present specimen was deemed sufficiently interesting and important for very close comparative study with other specimens. This has largely been possible through the kindness of my colleague, Mr. H. W. Parker, who has given me access to all the skeletons of snakes preserved in the Zoological Department of the British Museum. Such comparison establishes the fact that the vertebrae under consideration are closely similar to those of the fossil genus *Paleryx*, Owen (syn. *Palæopython*, Rochebrune), not only in their general characters, but also in the presence of a well-developed hypapophysis. In *Paleryx*, however, this hypapophysis is only well developed in the anterior pre-caudal vertebrae, whilst in the present form it remains conspicuous until the mid-body region.

It is impossible to fit the specimen into any genus of fossil or recent snakes; and I, therefore, propose to create a new genus for its reception.

### Family Boidæ.

#### Genus DAUNOPHIS, *gen. nov.*

Centra of vertebrae short and wide. Vertebrae closely resembling those of *Paleryx*, with no bony prolongation beyond the articular surface of the anterior zygapophysis. Anterior zygapophysis long and narrow. Articular ball and socket more transversely flattened than in *Paleryx*, being

*Daunophis langi*, sp. n.

**Material.** Bony remains and impression of practically complete snake.

**Dimensions :—**

Mid-precaudal vertebrae:—

Length of centrum	7.5
Breadth across anterior zygapophyses	15.0
Anterior zygapophysis, length	5.0
breadth	2.0
Hypapophysis, length	4.5
Mid-ribs, length	60.0
diameter at point of attachment	3.0

For convenience in reference certain points in the Plate have been lettered (see Pl. XVI.). In the Plate it is quite easy to follow the course of the vertebral column, despite the gash at AB, and it is evident the snake was partly coiled. From the head the column runs to A, and no doubt continued to B. From this point its course is seen along B, C, D, E, F to G. At G it turns sharply, though naturally upwards, and passes under the thickest part of the column to I, and thence to J, where it ends. Most of the turns on this course are quite natural with the exception of that at F, where the back-bone is clearly broken. At the same time, it is quite evident that the skeleton has been twisted at several points.

*Skull.* Nothing is left of the skull. The matrix here has been much altered by organic matter, and it is very difficult to say in what position the skull was lying. A cast of the

head-region shows very little that can be definitely identified. The first two cervical vertebræ seen in this cast seem to have been larger, but very similar to those figured by Zittel ('Grundzüge der Paläontologie,' Abt. 2, 4th ed. p. 267, fig. 374) for *Python bivittatus*, a recent form from Sumatra. It should be pointed out that the head-region appears much more satisfactory in the Plate than in the actual specimen.

*Precaudal Vertebræ.* The number of precaudal vertebræ is approximately 200. It is surprising that in this number of vertebræ and vertebral impressions not one complete vertebra is preserved—indeed, at certain places it is difficult to say in what position the vertebræ were lying. Nevertheless, by consideration of the many portions preserved, a fairly accurate idea of the vertebral characters can be obtained. In the neck-region the vertebræ are gone, and only an impression of the apophysis remains. In the region from the head to the point A, with the exception of the most anterior, the vertebræ appear to have been in their normal position, and have left impressions of the ribs and the stout hypapophysis in the somewhat altered matrix. From B to D the vertebræ are also seen in dorsal view, the greater part of their upper surface being lost. A close examination of this point, however, reveals many features of the vertebral structure. In the vertebræ of the region around C, the length and breadth of the centra can be made out quite clearly. The ball is quite clear on the posterior end, while not only the ribs but the anterior and posterior zygapophyses are quite evident in their normal position. The average length of the centra here is 7.5 mm., which is comparatively short when compared with the width of the vertebræ and the size of the anterior zygapophyses, which are well preserved. There can be no doubt as to the correctness of the measurements here, as one or two of the vertebræ show the zygapophyses articulating naturally. Where the vertebræ have been badly fractured, it is easy to remove the crushed parts and find the hypapophysis fast in the underlying matrix. This process is quite distinct from that of the modern Colubrid and Viperine snakes, and is strongly reminiscent of the type in *Paleryx*, although in *Daunophis* the hypapophyses are well developed more posteriorly on the vertebral column than in that genus.

The anterior zygapophyses are comparatively large, being 5 mm. long and 2 mm. broad. The breadth of the vertebræ measured across the tips of the zygapophyses is 15 mm. The breadth of the centrum is approximately 5 mm. on its under side. The depth of the hypapophyses, as far as can



be ascertained, is 4.5 mm. These figures agree in a striking manner with those of an anterior precaudal vertebra of *Paleryx rhombifer* from the Eocene of Caylux, France (see Cat. Foss. Rept. Brit. Mus. 1888, vol. i. p. 255, R 428 b), which I have before me. The vertebræ agree very closely, and at one place on the present specimen, where a vertebra is completely missing, this *Paleryx* vertebra fits almost exactly. On the *Daunophis* specimen the vertebra is in a position posterior to that of the *Paleryx* vertebra. The vertebræ of the specimen under consideration are slightly wider, shorter, and apparently not quite so high as those of *Paleryx*. The articular ball of the centrum is slightly flatter, and the anterior zygapophysis differs in being slightly more rounded at the external edge and less contracted on the inner (towards the centrum) end.

In the region from C to D very little of the vertebræ can be seen, but it is clear that the hypapophyses are much less prominent and are disappearing. From D to E most of the vertebræ are lost, and only impressions of the ribs are to be seen. From E to F all that can be made out is that the vertebræ have been crushed, and are lying on their left side with only a part of the right zygosphenes showing above the matrix. Several attempts were made here to excavate more of the vertebræ, but without success. Posterior to this practically all the vertebræ are gone, leaving only some impressions in the matrix. It is important to note, however, that there is absolutely no trace of a hypapophysis in this region.

*Caudal Vertebrae.* In the tail just between I and J the upper surfaces of two vertebræ can be seen with the truncated neural spine. The features visible in the posterior vertebræ only serve to confirm the general idea already obtained from the anterior.

*Ribs.* Impressions and remains of ribs can be seen all along the vertebral column, except at the anterior and posterior ends. They are best developed in the mid-body region, where they attain the length of almost  $2\frac{1}{2}$  inches (63 mm.). Near the point of attachment to the vertebræ the diameter of the rib is 3 mm. I have not been able to see the actual articular head.

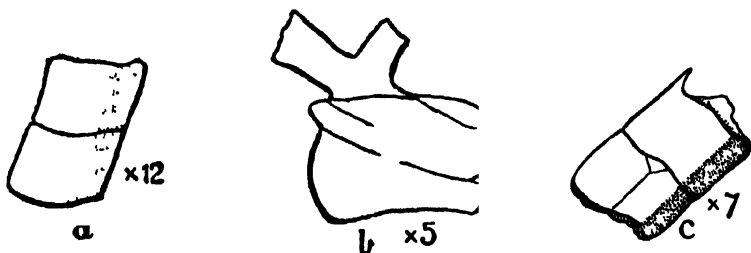
*Integument.* One of the most interesting features of the specimen is that some traces of the epidermis are left. These show in three places, and it is difficult to imagine that either of the pieces is complete—at any rate, it is quite impossible to identify them with the scales of any recent snakes.

In the head-region (text-fig. 1 a) are two minute scales.

The anterior of these slightly overlaps the posterior, but their size is too small to be comparable with any recent species I have been able to examine. They are 1 mm. broad, and together 1.5 mm. in length (antero-posteriorly). A striking feature is the comparatively great thickness of the scales.

In the posterior region—to the right of H in Pl. XVI.—there are remains of three large shields, just like ventral shields, but larger and thicker. They do not show any structure which might provide a clue as to their origin or position in life (text-fig. 1 *b*).

There is a third trace of epidermis just at the tip of the tail (text-fig. 1 *c*). Here two scales can be seen, very similar to those in the head-region, but larger and thicker. The scales convey very little which might help in identification. Their contradictory size seems to preclude their



Remains of epidermis.

(a) In head-region; (b) in mid-body region; (c) in tail-region.

belonging to the snake, yet there is no reason to suppose that they belonged to any creature used as food by the snake. If the latter was the case, it is difficult to understand what type of creature it was.

**Conclusion.** All the features which can be made out in the snake point to one conclusion—namely, that it belongs to a new genus. The general characters and proportions of the vertebræ are closely similar to those of the Boidæ, and warrant its reference to that family. In the modern Boidæ, and most of the fossil genera, the hypapophyses are confined to the anterior precaudal vertebræ—at least, as prominent processes,—and it is difficult to understand the significance of their persistence some distance more posteriorly in this Burmese form. Many recent snakes, such as some Colubridæ and Viperidæ, have hypapophyses all along the vertebral column (a feature which seems constant also in the sea-snakes), but the specimen under consideration has no trace of them in the later vertebræ.

The specimen has an important bearing on the age of the

deposits in which it was found. It is, undoubtedly, closely similar to *Paleryx*, a genus which is restricted to the Lower Tertiary, and whose extreme upward range is the Lower Miocene. This makes it very unlikely that *Daunophis* is a late form. Most probably it lived in Pliocene times, and certainly not in the Pleistocene. Prof. Gregory, arguing from general considerations, is in favour of assigning these beds to the Pliocene (Gregory, *loc. cit. supra*); the specimen under consideration appears to confirm this view.

The specimen, at any rate, is of considerable interest; and it is to be hoped that further Ophidian remains may be collected from these oil-shales in Burma.

In conclusion, I have to record my appreciation of the kindness of Prof. Gregory in allowing the specimen to be sent to me for examination. I have also to thank my colleague, Mr. H. W. Parker, for much kind help regarding recent snakes and for reading the manuscript of this paper; and, finally, I am indebted to Dr. Malcolm A. Smith, of Bangkok, for valuable aid with regard to the snakes of Burma and Siam.

#### EXPLANATION OF PLATE XVI.

*Daunophis langi*, gen. et sp. n. (type-specimen). About  $\frac{2}{3}$  nat. size.

L.—*Eogypona*, Kirkaldy: an interesting Case of Synonymy in the Jassoidea (Homoptera). By W. E. CHINA.

(Published by permission of the Trustees of the British Museum.)

IN 1900 Kirkaldy renamed two species of *Gypona*, Germar, the names of which were preoccupied within the genus. These were *Gypona striata*, Kirby, 1891 (nec Burmeister, 1838), which was renamed *G. kirbyi*, Kirk., and *Gypona prasina*, Walker, 1858 (nec Burmeister, 1838), which was renamed *G. walkeri*, Kirk.

In 1901 (Entomol. xxxiv. p. 38) Kirkaldy erected a new genus *Eogypona* to hold two species which he in some way or other had wrongly identified as *G. kirbyi*, Kirk., and *G. walkeri*, Kirk. In his generic description he carelessly omitted to mention the position of the ocelli—a character of the utmost importance in the scheme of classification then existing in the family. The hind tibial armature, however, at once indicated that the genus had nothing whatever to do with *Gypona*, Germar.

Both Kirby's and Kirkaldy's types were loaned to

Melichar\* for the preparation of his work on the Homopterous Fauna of Ceylon, published in 1903, and in this volume Melichar correctly referred *G. striata*, Kirby (= *G. kirbyi*, Kirk., 1900), to *Siva*, Spinola, 1852 (= *Krisna*, Kirk., 1900), and erected a new genus *Acropona*, Mel., to hold *G. prasina*, Walk. (*G. walkeri*, Kirk., 1900).

For some inexplicable reason Melichar not only overlooked Kirkaldy's new names for these two species, but he overlooked the publication of Kirkaldy's new genus *Eogypona*, and regarded it as a MS. name. However, having Kirkaldy's type-specimens before him, he could not fail to recognize that Kirkaldy had been in error in his determinations.

Adopting, as he supposed, Kirkaldy's manuscript names of *kirbyi*, Kirk., and *walkeri*, Kirk., Melichar redescribed these specimens, erroneously referring them to the genus *Ledropsis*, White (1844), which apparently he had not correctly diagnosed. At the same time he synonymized under *Ledropsis*, White, the supposedly manuscript name *Eogypona*, Kirk.

In 1907 Kirkaldy ('Leaf Hoppers,' Supplement, p. 25) complained of Melichar's treatment (as unpublished) of his genus *Eogypona*, and, realizing that Melichar had wrongly diagnosed *Ledropsis*, White, pointed out that *Eogypona* was synonymous with *Petaloccephala*, Stål, 1853 (= *Camptelasmus*, Spin., 1852?). He failed, however, to realize that his determinations of the Kirbian and Walkerian species had been wrong, and even stated that his description of *Eogypona* had been founded on a co-type of *G. striata*, Kirby. This was impossible, since the actual specimen described by Kirkaldy and seen by Melichar and labelled "*Eogypona kirbyi*, Kirk., type" in Kirkaldy's handwriting, was collected at Pundaluoya in August 1898, seven years after Kirby had described his species *striata*.

Distant, in 1908 (Faun. Brit. Ind., Rhyn. iv.), having overlooked Kirkaldy's 1907 remarks, was led astray by Melichar's treatment of *Eogypona*, and absolutely failed to grasp the significance of what had occurred. This was probably due to the fact that he had not seen Kirkaldy's specimens, which were not presented to the British Museum until 1912. Having the types before him, he correctly followed Melichar in referring Kirby's and Walker's species to *Krisna* and *Acropona* respectively, but he synonymized each of Kirkaldy's two species of *Eogypona* under two distinct genera. On p. 170 he gave *E. walkeri*, Kirk., as a manuscript synonym of *Petaloccephala walkeri*, Mel., whilst on p. 300 he gave it as a true synonym of *Acropona prasina*,

\* As stated in the preface to his work, p. iv.

Walk. On p. 169 he gave *E. kirbyi*, Kirk., as a manuscript synonym of *Petaloccephala nigrilinea*, Walk., with which he had incorrectly synonymized *Ledropsis kirbyi*, Mel., whilst on page 298 he gave it as a true synonym of *Krisna striata*, Kirby.

If Kirkaldy's determinations had been correct then *Eogypona*, Kirk., would have become a synonym of *Krisna*, Kirk., since he had fixed *E. kirbyi*, Kirk., as the genotype. But, as realized by Melichar (1903), the two species on which he founded the genus are entirely different from Kirby's and Walker's species. *Eogypona*, Kirk., therefore, becomes, as suggested by Kirkaldy himself (1907), a synonym of *Petaloccephala*, Stål, and its two species will be known as *P. kirbyi*, Mel., and *P. walkeri*, Mel.

The synonymy of the four species concerned will thus be as follows:—

*Acropona walkeri*, Kirk.

1858. *Gypona prasina*, Walker (nec Burm., 1838), List Homopt., Supplement, p. 258.  
 1900. *Gypona walkeri*, Kirkaldy, Entomologist, xxxiii. p. 294 (nom. nov.).  
 1903. *Acropona prasina*, Melichar, Homopt. Faun. Ceylon, p. 168.  
 1908. *Acropona prasina*, Distant, Faun. Brit. Ind., Rhyn. iv. p. 300.

*Krisna kirbyi*, Kirk.

1891. *Gypona striata*, Kirby (nec Burm., 1838), Journ. Linn. Soc., Zool. xxiv. p. 171.  
 1900. *Gypona kirbyi*, Kirkaldy, Entomologist, xxxiii. p. 294 (nom. nov.).  
 1903. *Siva striata*, Melichar, Homopt. Faun. Ceylon, p. 167.  
 1908. *Krisna striata*, Distant, Faun. Brit. Ind., Rhyn. iv. p. 298.

*Petaloccephala walkeri*, Mel.

1901. || *Eogypona walkeri*, Kirkaldy (nec *G. walkeri*, Kirk., 1900 = *Acropona*), Entomologist, xxxiv. p. 39.  
 1903. *Ledropsis walkeri*, Melichar, Homopt. Faun. Ceylon, p. 144.  
 1907. || *Camptelasmus walkeri*, Kirkaldy (nec *G. walkeri*, Kirk., 1900 = *Acropona*), Leaf Hoppers, Supplement, p. 25.  
 1908. *Petaloccephala brachycephala*, Distant, Faun. Brit. Ind., Rhyn. iv. p. 170 (syn. nov.).  
 1908. *Petaloccephala walkeri*, Distant, loc. cit.  
 1908. *Acropona prasina* (part.), Distant, op. cit. p. 300.

*Petaloccephala kirbyi*, Mel.

1901. || *Eogypona kirbyi*, Kirkaldy (nec *G. kirbyi*, Kirk., 1900 = *Krisna*), Entomologist, xxxiv. p. 39.  
 1903. *Ledropsis kirbyi*, Melichar, Homopt. Faun. Ceylon, p. 143.  
 1907. || *Camptelasmus kirbyi*, Kirkaldy (nec *G. kirbyi*, Kirk., 1900 = *Krisna*), Leaf Hoppers, Supplement, p. 25.  
 1908. *Petaloccephala nigrilinea*, Distant (part.), Faun. Brit. Ind., Rhyn. iv. p. 169.  
 1908. *Krisna striata* (part.), Distant, op. cit. p. 298.

BIBLIOGRAPHICAL NOTICE.

*A General Consideration of Snake-Poisoning, and Observations on Neotropical Pit-Vipers.* By AFRANIO DO AMARAL. 64 pp., 14 pls. Harvard University Press; Oxford University Press, London; Humphrey Milford. Price 10s. 6d. net.

THIS book consists of two distinct sections. The first portion contains a concise summary of the more interesting facts concerning snake-venom, its occurrence, chemical composition, toxicity, physiological action, and antidotes. It contains little new, and, occupying as it does only twenty-one pages, is necessarily not exhaustive in its treatment of the subject; it is chiefly concerned with the American snakes, with which the author is most familiar.

The second section consists of five short systematic papers dealing with some of the South American vipers, and is illustrated by numerous plates. The first paper deals with the vexed question of the specific identity or otherwise of the fer-de-lance, jararaca, and jararacussu. Dr. Amaral has examined a very large series of specimens, and finds that there are three distinct species. There follow two short papers dealing with the variation of the colour-pattern in four species of Brazilian pit-vipers and one in which the probable evolution of the dorsal markings of the jararacussu is discussed. The last paper is a study of the geographical variation of *Bothrops neuwiedii* (Wagler), with descriptions of seven new subspecies, which are characterized chiefly by differences of colour.

Dr. Amaral has had at his disposal a much finer collection for comparative study than any other worker in the same field, and so must speak with authority. For the student the utility of the book would have been considerably increased by the inclusion of keys in the systematic portions.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

May 20th, 1925.—Dr. J. W. Evans, C.B.E., F.R.S.,  
President, in the Chair.

The following communication was read :—

'The Liassic Rocks of the Radstock District (Somerset)'. By John William Tutchet and Arthur Elijah Trueman, D.Sc., F.G.S.

The Liassic rocks described are those found within a radius of about 4 miles from Radstock. These rocks are unusually interesting, because in some divisions they are very thin; the total

thickness of Lias does not exceed 200 feet, and is often much less. The succession may be summarized as follows:—

	Feet.
Upper Lias: Sands, marl, and ironshot limestone, up to ..	9
Middle Lias: Unknown, probably always absent.	
Lower Lias: <i>Striatum</i> and <i>Capricornum</i> Clays, up to ..	120
<i>Jamesoni</i> Limestone, up to ..	10
<i>Armatum</i> Bed, with derived <i>Echiocerates</i> ...	0 to 1½
<i>Raricostatum</i> Clay .....	0 to 1½
<i>Obtusum</i> Nodules .....	½ to 2½
<i>Turneri</i> Clay .....	0 to 5
<i>Bucklandi</i> Bed ( <i>Euagassiceræ</i> , etc.) .....	0 to 1
<i>Angulata</i> and <i>Planorbis</i> Zones .....	2 to 30
White Lias, with Sun-Bed ..	20

The peculiarities of the Lias of this district are known to be related to its position immediately north of the Mendip Axis, along which movement took place intermittently during the early Mesozoic Era. Notwithstanding the numerous non-sequences within the Radstock Lias, an unusual number of ammonite faunas are richly represented, often in remanié deposits.

Studies of the succession in many exposures have made it possible to elucidate in some detail the nature of the movements that took place during the deposition of the Lower Lias. These conclusions may be summarized as follows:—

- (1) Deposition of White Lias during a time of fairly uniform subsidence; similar conditions during the deposition of the *Planorbis* and *Angulata* Zones, but less uniform.
- (2) Period of folding along east-and-west axes, and denudation of the anticlinal areas.
- (3) Deposition renewed during the hemera of *Sauzeani* (*Bucklandi* Bed). Deposition continued intermittently during the formation of the *Turneri* Clay.
- (4) Uplift in the south, followed by denudation of much of the clay there.
- (5) Deposition of the *Obtusum* Nodule-Bed, a thin remanié bed; deposition of the *Raricostatum* Clay.
- (6) Renewed uplift in the south, and denudation of varying amounts of earlier deposits.
- (7) Deposition of the *Armatum* Bed in the south only, a remanié bed.
- (8) Deposition of the *Jamesoni* Limestone, fairly uniformly; further uniform deposition during the formation of the *Striatum* and *Capricornum* Clays.

The paper includes faunal lists and some palæontological notes on the ammonites.

#### MISCELLANEOUS.

##### *The Fauna and Flora of Apple Bark: a Correction.*

IN Mr. S. Stuart Light's paper on "The Fauna and Flora of Apple Bark" (*Ann. & Mag. Nat. Hist.* ser. 9, vol. xvii. pp. 126-140) the following correction should be made:—

On page 134, *Operophtera brumata*, Linn. (the Winter Moth), should come under the *Geometridæ*, and not, as printed, under the *Notodontidæ*.

THE ANNALS  
AND  
MAGAZINE OF NATURAL HISTORY.  
[NINTH SERIES.]

No. 100. APRIL 1926.

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LL.—*On new Curculionidæ from the Oriental Region (Col.).*  
By GUY A. K. MARSHALL, C.M.G., D.Sc., F.R.S.

Subfamily PRIONOMERINÆ.

*Ochyromera artocarp*, sp. n.

♂ ♀. The integument testaceous, the elytra and the apical margin of the prothorax (narrowly) darker; the whole body rather thinly clothed with fine setiform golden scales and set with stiff suberect setæ, which are black on the dorsum and pale at the sides; the elytra with numerous irregular ill-defined small bare spots.

*Head* with close shallow punctures and slightly constricted behind the eyes, which are vertical, broadly ovate (4:3), and moderately convex; the forehead about as broad as the antennal club and with a row of stiff erect black setæ on each side. *Rostrum* a little longer than the pronotum in ♂ (7:6), still longer in ♀ (8:6), almost straight and parallel-sided; with five narrow straight dorsal carinæ on the post-antennal area and a row of punctures in each interstice, and a darker curved lateral carina above the scrobe; the apical area shiny and very minutely punctate in ♀, more strongly so in ♂; the scrobe extending to more than halfway between the antenna and the apex; on each side of the



dorsum a row of stiff erect setæ continuous with those on the forehead. *Antennæ* inserted at the middle in ♀ and beyond it in ♂; the scape about as long as the funicle, in which joint 1 equals 2+3+4 and joint 2 equals 3+4, 3-6 bead-like and transverse, and 7 also transverse but longer and wider. *Prothorax* somewhat transverse (4:3), strongly rounded at the sides, widest at the middle, strongly constricted near the apex and there subtubulate, the basal margin shallowly bisinuate; the dorsum slightly convex longitudinally, highest at the middle, rather coarsely and closely punctate throughout, the punctures being partly hidden by the recumbent golden setæ, which are transverse on the apical half and oblique on the basal; the suberect setæ rather sparse, black on the anterior half of the disk and pale on the base and sides. *Scutellum* small, subtriangular, and thinly setose. *Elytra* oblong-ovate, much wider than the prothorax, almost parallel-sided from the roundly rectangular shoulders to far beyond the middle, and separately rounded at the apex; the striae shallow and distinctly punctate, the punctures diminishing behind; the intervals feebly convex and impunctate, each bearing a row of erect setæ, which are more numerous on the alternate intervals, each seta arising from a small bare patch; a small tuft of black setæ on interval 3 and another on the posterior callus, which is well developed, a very shallow indefinite impression on each elytron from the scutellum obliquely to stria 4 at about one-fourth from the base. *Legs* testaceous, thinly clothed with fine recumbent setæ and coarser subrecumbent ones: the front femora with the usual very large tooth, its anterior edge being twice the length of the space between the base of the tooth and the apex of the femur; the front tibiae broadly dilated at the apex and with a sharp point at the inner angle.

*Length* 2·7-3·0 mm., *breadth* 1·2-1·3 mm.

**SOUTH INDIA:** Mysore, i. 1918 (*T. V. Ranakrishna*); Shiradi, S. Kanara, i. 1918 (*T. V. R.*).

This species has been bred from larvæ found in jak fruit (*Artocarpus integrifolia*).

Described from seven specimens.

*Ochyromera subcruciata*, sp. n.

♂ ♀. Integument black or piceous, fairly densely clothed with light brown setiform scaling (through which the integument shines in high lights), the elytra having a very indefinite broad grey stripe curving from the shoulder to the

suture and then out again to the posterior callus, the two stripes forming a common X-like marking; the lower surface with uniform pale fawn setiform scaling.

*Head* closely and shallowly punctate and not constricted behind the eyes, which are longitudinal, broadly ovate (4:3), and less convex than usual; the forehead broader than the antennal club, thinly clothed with recumbent setæ and with a rounded median fovea. *Rostrum* shorter than the head and pronotum (12:16) in ♂ and longer (17:16) in ♀, cylindrical from the base to the antennæ and then gradually dilated to the apex, very strongly curved in ♀ and much less so in ♂, with seven low carinæ on the basal section, the interstices having a row of shallow confluent punctures, but a duplicated row on each side of the median carina; the apical section strongly punctate in both sexes, but the punctures more confluent in ♂; the scrobes continued very shallowly beyond the antennæ, separated beneath at the base only by a carina; the dorsum with transverse recumbent pale brown setæ, which are more numerous in ♂. *Antennæ* inserted at a little beyond the middle in ♀ and at one-fourth from the apex in ♂, piceous; the scape much longer than the funicle (8:5); joint 1 of the funicle equal to 2+3, 2 equal to 3+4, 3 a little longer than broad, 4-7 bead-like and transverse, 7 being a little longer and broader than the others. *Prothorax* transverse (3:2), only slightly widening from the base to the middle, then narrowed in a curve to the subtubulate apex, the basal margin being shallowly bisinuate; the dorsum almost flat longitudinally, coarsely and closely punctate throughout, with a trace of a low obtuse median costa in the middle; the setiform scales all transverse, forming an indefinite denser stripe on each side of the median line; the true setæ pale orange and all recumbent. *Scutellum* subcordate and sparsely setose. *Elytra* oblong-ovate, broadly rounded at the shoulders, parallel-sided from there to far beyond the middle, and broadly rounded behind; the striæ scarcely impressed except at the apex and on the inflexed margins, the punctures large and separated by about their own diameter, each containing a recumbent seta; the intervals broad and flat, each with a row of recumbent pale orange setæ, which towards the base and apex arise from small depressed shining granules, intervals 3 and 9 costate at the apex, the posterior callus strongly developed, and a shallow quadrate common depression behind the scutellum. *Legs* black or piceous, unevenly clothed with recumbent pale setæ; the front femora with the anterior edge of the tooth only slightly longer than the space between the base

of the tooth and the apex of the femur ; the front tibiæ only slightly dilated towards the apex, without any internal apical process.

*Length* 4·5–6·6 mm., *breadth* 1·8–3 mm.

**SOUTH INDIA:** Nilgiri Hills (*H. L. Andrewes, A. K. W. Downing*—type); Yercaud, Shevaroy Hills, 5000 ft., viii. 1917 (*Y. Ramachandra Rao*).

Described from fifteen specimens.

*Ochyromera binubilosa*, sp. n.

♀. Integument dark red-brown, the pronotum (except the apical margins) and the head blackish ; the pronotum with short sparse recumbent fulvous setæ on the dorsum, which become more numerous at the sides ; the elytra not very densely clothed with small narrow coppery scales, which vary much in length, and each with an indefinite suboblong transverse patch of grey scaling behind the middle between striæ 3 and 8.

*Head* rugosely punctate above and rather strongly striolate at the side, with sparse recumbent pale setæ ; the forehead similarly sculptured and clothed, with no definite median fovea, and a little broader than the antennal club ; the eyes very broadly ovate, only slightly convex, the curvature continuous with that of the head. *Rostrum* twice as long as the pronotum, cylindrical to near the apex and then distinctly dilated, coarsely punctate in the basal section, some of the punctures confluent, and with a mere trace of a median carina ; the apical section with fine sparse punctures, and a short median stria between the antennæ ; the scrobes widely separated at the base. *Antennæ* elongate, red-brown ; the funicle as long as the scape, with all the joints longer than broad, joint 1 nearly as long as 2+3+4 ; the club elongate and rather loose, with joint 1 slightly longer than broad. *Prothorax* transverse (5:4), almost parallel-sided from the base to the middle, thence narrowing rapidly to the apex without any constriction, the base very feebly bisinuate, the dorsum almost flat longitudinally, with large coarse subreticulate punctures, with the interspaces finely and shallowly punctate and a trace of a median carina in the basal half ; the setæ short, recumbent, oblique and sparse on the disk, denser and transverse on the sides. *Scutellum* elevated, subpentagonal, with fine rugulose punctures and sparsely setose. *Elytra* ovate, subtruncate at the base, widest at the shoulders, then very gradually narrowing posteriorly and broadly rounded at the apex, laterally constricted before the apex, the posterior calli being obtusely

prominent, and with a shallow transverse impression on each side of the suture at one-fourth from the base; the striæ straight and shallow, the punctures large and separated in the basal half, becoming much reduced behind and each containing a minute horizontal seta; the intervals much broader than the striæ, irregularly set with small shiny granules, the scaling thin, so that the finely aciculate integument is readily visible. *Legs* elongate, piceous, rather thinly clothed with recumbent setæ, which are pale brown above and grey beneath; the front tibiæ broadly dilated towards the apex and with the inner apical angle rounded off.

*Length* 6.6 mm., *breadth* 3 mm.

BORNEO: Mt. Matang, Sarawak, xii. 1910, 1 ♀ (G. E. Bryant).

*Ochyromera bryanti*, sp. n.

♂ ♀. Integument varying from fulvous to piceous brown; the pronotum with not very dense transverse golden-yellow hair-scales and three indefinite dark stripes in which the scales are more sparse, the elytra with similar golden-yellow hair-scales, interrupted here and there by elongate dark patches clothed with fine brown pubescence and forming a regular pattern; dark patches distributed thus: on interval 3 a shorter patch before the middle and a longer one behind it, interval 5 with one at the base (as long as the antemedian one on 3) and another of the same length at about the middle, interval 4 with a small patch linking the apex of the median patch on 5 with the base of the postmedian one on 3, and a patch on the conjoint apices of 3-5; the lower surface rather closely covered with pale golden recumbent setæ or hair-scales.

*Head* with fine shallow punctures dorsally, striolate laterally, and thinly clothed with recumbent golden setæ; the eyes very broadly ovate and a little more convex posteriorly than the head; the forehead about as wide as the antennal club, with a shallow median fovea, invaded anteriorly by the rostral carinæ, and with a few stout suberect setæ. *Rostrum* half as long again as the pronotum in ♂, more than twice as long in ♀ (but varying appreciably in length), nearly straight, and not or but very little widened at the apex; in ♂, with seven carinæ (including the upper margin of the scrobe) in the basal portion, the intervening furrows finely but rugosely punctate and bearing transverse suberect fulvous setæ, the apical area with rather large but less confluent punctures, the scrobes continued more than half-way beyond the antennæ; in ♀, with the carinæ less distinct

and all the punctures much finer. *Antennæ* inserted at about the middle (♀) or a little beyond it (♂); the funicle a little shorter than the scape, which does not reach the eye, joint 1 as long as 2+3, 3 longer than broad, 4-7 as long as broad. *Prothorax* transverse, parallel-sided from the base to the middle, then rapidly narrowing to the apex without any constriction, the base moderately bisinuate; the dorsum slightly convex longitudinally, with strong separated punctures, the interspaces shiny and with minute shallow punctures; the pleuræ more closely and coarsely punctate, the interspaces opaque and finely aciculate; the hair-scales transverse, the setæ rather stout, subtruncate, and slightly raised. *Scutellum* ovate, sparsely setose. *Elytra* rather broadly ovate, almost parallel-sided from the widely rounded shoulders to the middle, thence narrowed and rather broadly rounded behind, only slightly constricted laterally near the apex, with the posterior calli feeble and with a broad shallow impression starting at the suture at one-fourth from the base and running obliquely backwards to stria 3; the striæ shallow, with deep separated punctures which become much smaller behind the middle, striæ 2 and 3 strongly sinuated on the declivity; the intervals broad and almost flat, sometimes slightly rugulose transversely towards the base, each with a row of stout curved suberect yellow setæ. *Legs* rather thinly clothed with yellow setæ; the front tibiæ strongly dilated near the apex, and with the inner apical angle rounded off.

*Length* 4.2-6 mm., *breadth* 2.1-5 mm.

BORNEO: Quop, W. Sarawak, ii.-iii. 1914 (G. E. Bryant—type). MALAY PENINSULA: Singapore (W. J. Saunders); Penang, x. 1913 (G. E. Bryant).

Described from eight specimens.

*Ochyromera subvittata*, sp. n.

♂. Integument testaceous-brown, with the pronotum, sternum, and interval 1 on the elytra rather darker; the pronotum with rather dense transverse golden-yellow hair-scales, with a broad ill-defined denuded median stripe; the elytra rather thinly clothed with golden-yellow hair-scales, these being more dense on intervals 3, 5, 7, 9.

*Head* transversely aciculate and almost bare on the vertex, with fine close shallow punctures and golden pubescence in front, shallowly constricted behind the eyes, which are moderately convex; the forehead as broad as the antennal club, with rather dense golden pubescence and a rounded

median fovea. *Rostrum* a little longer than the pronotum (9:8), scarcely dilated at the apex, gently curved, and with seven narrow carinæ in the basal portion, the intervening punctures shallow and confluent; the scrobes not continued beyond the antennæ and broadly separated at the base. *Antennæ* inserted beyond the middle (♂), testaceous, the funicle as long as the scape, joint 1 equal to 2+3, 3-5 bead-like and as long as broad, 6 a little longer and broader, 7 still broader and slightly transverse. *Prothorax* transverse (3:2), very slightly rounded at the sides, being almost parallel-sided from the base to beyond the middle, shallowly constricted and subtubulate at the apex, the base scarcely bisinuate, the dorsum almost flat longitudinally, closely and coarsely punctate throughout, but the punctures hidden laterally by the hair-scales. *Scutellum* small, cordate, almost bare. *Elytra* oblong-ovate, subtruncate at the base, with the shoulders obliquely rounded, subparallel-sided from there to the middle, rather broadly rounded behind, shallowly constricted laterally near the apex, with the posterior calli rather feeble and with a small flattened area behind the scutellum; the striæ shallow, with rather close distinct punctures, which very gradually diminish behind, striæ 2 and 3 straight on the declivity; the intervals broad, almost flat, smooth and shiny, with numerous small obliquely-raised setæ that are with difficulty distinguishable from the hair-scales. *Legs* testaceous, thinly clothed with pale setæ; the front tibiæ dilated towards the apex, and with the inner apical angle rounded off.

*Length* 4.2 mm., *breadth* 2.1 mm.

BORNEO: Sarawak, 1923, 1 ♂ (*Dr. E. Mjöberg*).

*Ochyromera posticalis*, sp. n.

♂ ♀. Integument dark brown, not very shiny; the pronotum clothed with transverse dark brown hair-scales and with two dorsal stripes of pale yellowish hair-scales; the elytra thinly covered with small dark brown hair-scales and with the following yellow or yellowish-grey markings: a humeral patch, a very short stripe at the base of interval 2, another twice as long on 4, a few pale hair-scales at the base of 3, a spot before the middle on 2, and a broad irregular dentate macular band across the top of the declivity, the marking on interval 3 being extended backwards almost to the apex.

*Head* closely and finely punctate, with sparse setæ which are brown dorsally and yellowish laterally, and shallowly

constricted behind the eyes, which are moderately convex and broadly oval; the forehead distinctly broader than the antennal club, with a low median carina ending behind in a round fovea, and with a row of suberect yellow setæ on each side. *Rostrum* comparatively short and stout, shorter than the pronotum in ♀ (7:8) and more so in ♂ (6:8), distinctly curved, not dilated at the apex, with five close subconfluent punctures and five dorsal carinæ; that of ♀ slightly thinner and with the punctures somewhat finer; the scrobes exceptionally oblique, not continued beyond the antennæ, and narrowly separated at the base. *Antennæ* testaceous-brown; the funicle a little shorter than the scape, joint 1 slightly longer than 2+3, joints 3-7 transverse and progressively widening. *Prothorax* transverse (11:8), gently rounded at the sides, narrowed and feebly constricted near the apex, and scarcely bisinuate at the base; the dorsum flat longitudinally, rather rugosely punctured, and with the interspaces finely punctulate; the setæ transverse, rather stout, obliquely raised, and of the same colour as the adjoining hair-scales. *Scutellum* small, narrowly cordate, and thinly setose. *Elytra* oblong-ovate, subtruncate at the base, parallel-sided from the obliquely-rounded shoulders to beyond the middle, broadly subtruncate at the apex (seen directly from above), distinctly constricted laterally before the apex, with the posterior calli prominent, and with a slight flattening behind the scutellum; the striæ shallow, with strong punctures which gradually diminish behind, striæ 2 and 3 being somewhat curved on the declivity; the intervals broad, flat, and very finely rugulose, each with a row of stout curved subrecumbent bristles, which are usually dark on the dark areas and *vice versa*, but yellow setæ occur variably here and there on the dark parts, especially on intervals 1 and 5; the posterior calli with a small tuft of short setæ; the dark hair-scales very small and sufficiently sparse to allow the integument to be seen readily, the yellow ones much denser. *Legs* red-brown; with rather sparse recumbent pale setæ; the front tibiæ dilated towards the apex, but not very strongly, the inner apical angle being rounded off.

*Length* 3·6-3·9 mm., *breadth* 1·7-1·8 mm.

BURMA: Momeit (*Doherty*). ASSAM: Patkai Hills (*Doherty*).

Described from four specimens.

Pascoe (Journ. Linn. Soc., Zool. xii. 1874, p. 31) assigned two species to his genus *Ochyromera*, *O. rufescens* and

*O. dissimilis*, of which the former is now cited as the genotype. Concerning *O. dissimilis* he says: "The upper surface of this species has a somewhat varnished appearance, due to very minute silvery hair-like scales." This appearance is, however, really due to the fact that the specimen in the process of mounting had been smeared with a thin coating of gum tragacanth.

*Omphasus penicillatus*, Heller (Zool. Meded. Leiden, viii. 1925, p. 229), has seven joints in the funicle and not six, and it must therefore be transferred to *Ochyromera*.

These three species and the six described above can be distinguished by the following characters:—

*Key to the Genus Ochyromera.*

- 1 (4). Front tibiæ not dilated towards the apex.
- 2 (8). Elytra oblong-ovate, obtusely acuminate behind, widest at or before the middle, set with sparse recumbent setæ, and without any median elevation, stria 1 being quite straight; funicle of the antennæ much shorter than the scape, joint 7 not longer or broader than 6, the club with both the basal joints longer than broad; front tibiæ without any process at the inner apical angle. (Borneo.) ..... *dissimilis*, Pasc.
- 3 (2). Elytrasubquadrate, very broadly rounded behind, widest behind the middle, set with erect setæ and with several dense fascicles, and with a common obtuse median elevation, stria 1 being sinuated; funicle of the antennæ nearly as long as the scape, joint 7 longer and broader than 6, the club with both the basal joints much broader than long; front tibiæ with a stout sharp process at the inner apical angle. (Sumatra, Singapore.) ..... *penicillata*, Heller.
- 4 (1). Front tibiæ dilated towards the apex.
- 5 (8). Front tibiæ angulate internally at the apex.
- 6 (7). Rostrum distinctly curved; funicle shorter than the scape, joint 7 not broader than 6; prothorax not constricted at the base; elytra widest behind the middle, evenly clothed with setiform scaling and with sub-recumbent pale setæ on the disk; internal apical angle of the front tibiæ obtuse, not produced. (Singapore.).. *rufescens*, Pasc.
- 7 (6). Rostrum almost straight; funicle as



- long as the scape, joint 7 broader than 6; prothorax constricted at the base; elytra widest at the middle, set with stiff erect black setae on the disk, the setiform scaling uneven, leaving small bare spots; internal apical angle of front tibiae produced into a stout sharp point. (S. India.) ..... *artocarp*i, sp. n.
- 8 (5). Front tibiae rounded off internally at the apex.
- 9 (16). Mesosternal process strongly narrowed from base to apex.
- 10 (15). Scrobes almost longitudinal, widely separated at the base; posterior calli on the elytra without any tuft of setae.
- 11 (12). Elytra red-brown, with a faint oblong transverse grey patch behind the middle between striae 3 and 8, the intervals with irregular small shiny granules, the posterior calli prominent; antennae with all the joints of the funicle and the first of the club longer than broad. (Borneo.) ..... *binubilosa*, sp. n.
- 12 (11). Elytra without grey patches or granules, and the calli feeble; the median joints of the funicle not longer than broad and the first joint of the club transverse.
- 13 (14). Elytra clothed with golden-yellow hair-scales, with elongate patches of minute sparse blackish pubescence (especially on intervals 3, 5, 7); each interval with a row of stout curved suberect setae; striae 2 and 3 markedly sinuate on the declivity; prothorax not constricted near the apex. (Borneo, Malay Peninsula.) ..... *bryanti*, sp. n.
- 14 (13). Elytra with complete stripes of rather dense golden-yellow hair-scales on intervals 3, 5, 7, the hair-scales sparse on the rest of the dorsum; the intervals with numerous small obliquely-raised setae that are with difficulty distinguishable from the hair-scales; striae 2 and 3 quite straight on the declivity; prothorax shallowly constricted near the apex. (Borneo.) . . . *subvittata*, sp. n.
- 15 (10). Scrobes strongly oblique, approximated at the base; posterior calli on elytra with a small tuft of short setae; elytra dark brown, with yellowish markings at the base and near the apex. (Burma.) ..... *posticalis*, sp. n.
- 16 (9). Mesosternal process perpendicular, dilated and broadly truncate at the apex; elytra with light brown hair-scales and a common broad x-shaped grey marking. (S. India.) ..... *suberuciata*, sp. n.

## Subfamily CIONINÆ.

*Cionus meleagris*, sp. n.

♂ ♀. Integument piceous, with grey scaling variegated with spots formed of white and blackish scales, but entirely lacking the usual two circular sutural spots; the pronotum with mingled whitish and brown scales, and often with a transverse curved row of three ill-defined whitish spots; the elytra with the even-numbered intervals rather thinly clothed with grey scaling (composed of intermingled dirty white and brown scales), and the remaining intervals each with a row of alternating patches of dense white and blackish scales; the lower surface covered with elongate white scales, which are denser on the meso- and metasternum and form a dense lateral patch on each side of the third and fourth visible ventrites.

*Head* rather thinly clothed with brown and dirty white elongate scales; the forehead strongly narrowed from front to back (at its narrowest not wider than the funicle) and with recumbent scales. *Rostrum* about as long as the pronotum, gently curved, gradually widening from base to apex, much deeper than wide at the base, strongly and similarly punctate throughout in both sexes and rather indistinctly 5-carinate; from the base to the antennæ clothed with transversely-placed elongate pale scales, the apical area bearing obliquely-raised white setæ, which are finer in ♀ than in ♂. *Antennæ* testaceous, the club darker; the funicle a little longer than the club and with its two basal joints equal. *Prothorax* strongly narrowed from base to apex, with the sides almost straight, not constricted near the apex; the scaling recumbent and not dense enough to conceal the integument, the scales somewhat larger than those on the elytra and lying longitudinally with their apices directed forwards, except those in the middle of the extreme base which have their apices directed outwardly. *Scutellum* oblong-ovate, broadly rounded at the apex, and densely squamose. *Elytra* nearly as broad as long (5 : 6), with regular shallow striæ containing large deep punctures; striæ 1 and 2 quite straight and containing only a single row of punctures, the remaining dorsal striæ with the punctures more or less irregularly duplicated; the intervals much broader than the striæ, gently convex, and all of equal height, but interval 3 with a slight callus at the base; the pale and dark patches on the alternate intervals sharply defined and for the most part of approximately equal size,

but the dark scales much smaller and more convex than the white ones ; the punctures in the strizæ each with a white scale similar to those on the intervals. *Legs* piceous, with the tarsi paler; the femora with a stout tooth ; the tarsal claws unequal in both sexes. *Venter* of male only with a large shallow median depression on the two basal ventrites, which is clothed with fine subrecumbent hairs instead of scales, its posterior margin terminating in a dense fringe of erect hairs ; venter of ♀ with elongate scales in the middle.

*Length* 4.8 mm., breadth 3 mm.

MADRAS : Nilgiri Hills (A. K. Weld Downing).

Described from five specimens.

*Cionus transquamosus*, sp. n.

♂ ♀. Integument black, the general scaling varying from grey to fawn-colour ; the pronotum indefinitely variegated, there being usually three ill-defined paler longitudinal marks on the disk ; the elytra with the suture and alternate intervals each having a row of ill-defined patches or spots of blackish or dark brown scales, the intervening patches being usually paler than the unicolorous intervals and varying from whitish to pale buff ; the non-tessellated intervals with isolated dark scales scattered here and there ; no circular sutural black patches ; the sternum with fairly dense pale scaling, there being two dark patches on the metepisterna due to the presence of sparse narrower brown scales ; the scales on the abdomen less dense and becoming narrowly setiform in the middle in both sexes.

*Head* with variegated grey and buff scaling ; the forehead narrowed behind, but there broader than the funicle, and with a patch of erect scales near its posterior edge. *Rostrum* a little longer than the pronotum in both sexes, parallel-sided from the base to the antennæ, wider in the apical part, gently curved, somewhat compressed dorso-ventrally towards the apex, and not higher than wide at the base ; with very coarse, longitudinally confluent punctation throughout in both sexes (except for a small impunctate shiny patch at the apex), thus appearing more or less carinulate, but without the usual definite carinæ ; a few scales at the extreme base only, elsewhere with small dark transverse setæ. *Antennæ* black ; the funicle as long as the club and with its two basal joints equal. *Prothorax* parallel-sided from the base nearly to the middle, then strongly and rather abruptly narrowing towards the apex, near which it is shallowly constricted and becomes subtubulate ; the base bisinuate,

the median lobe not emarginate; the scales not dense enough to conceal the integument entirely, closely recumbent, and for the most part lying transversely with the apices inwards, except in the middle of the disk and on the apical portion, where the apices are directed forwards. *Scutellum* oblong-ovate and densely squamose. *Elytra* longer than broad (4:3), with straight shallow striæ, each containing a single row of rather small regular punctures; the intervals much broader than the striæ, slightly convex, and all finely and similarly punctate when abraded; interval 2 with a low callus at the base; the scales almost as dense on the even as on the uneven intervals, those on the latter more overlapping but never elevated; the punctures in the striæ bearing scales that are exactly similar to those on the intervals. *Legs* black, with the claws and sometimes the last tarsal joint reddish; the femora with a stout tooth and clothed with long narrow scales, with an indefinite band of broader denser scales on the anterior face; the tarsal claws equal in both sexes. *Sternum* with fairly dense scaling varying from grey to fawn, and with two dark thinly-scaled patches on the metepisterna. *Venter* with the scales in the middle much narrower than those at the sides and hair-like, longer in ♂ than in ♀ on the two basal ventrites and obliquely raised towards the hind margin of the second ventrite.

*Length* 3·9–4·5 mm., *breadth* 2·4–2·7 mm.

UNITED PROVINCES: Guchhupani, Dehra Dnn, viii. 1925 (*S. Bahadur*—type); West Almora, Kumaon, vii. 1918 (*H. G. Champion*). SIKKIM: Mungphu (*Lethierry*). ASSAM: Manipur (*Doherty*).

Described from nine specimens.

*Cionus championi*, sp. n.

♂ ♀. Integument shiny black, thinly clothed with setæ and with isolated patches of scales; the prothorax with rather sparse fawn-coloured setæ, irregularly variegated with white and black ones, and usually with an indefinite black area on each side of the disk on the basal half, which appears to be bare owing to the setæ being all black; the elytra rather thinly covered with similarly coloured setæ, and with a common patch of broad erect black scales on the suture at about one-third from the base, the patch being about as long as broad, extending laterally only to stria 1 and having its posterior edge emarginate; immediately behind this patch is an elongate one formed of obliquely

raised narrow creamy-white scales; behind this the suture bears somewhat irregular alternating clusters of fawn setæ and suberect narrow black scales till near the apex, before which is a subquadrate patch of suberect narrow creamy-white scales; the even intervals bearing mostly fawn setæ, the uneven ones with mostly white setæ interspersed with small patches of erect black scales; the lower surface with very sparse pale setæ, the posterior margin of the metasternum with a dense fringe of fawn setæ.

*Head* strongly and closely punctate, and with sparse variegated recumbent setæ; the forehead narrowed behind, but at its narrowest wider than the club of the scape; a fringe of erect setæ along the inner edge of the eyes. *Rostrum* much longer than the pronotum (3:2) in ♀, slightly shorter in ♂, parallel-sided throughout, somewhat flattened dorso-ventrally at the apex in ♀ but not in ♂, not deeper than its width at the base, with very coarse and longitudinally confluent punctures throughout in both sexes except at the extreme apex, which is shiny and impunctate; the dorsum slightly tectiform in the basal half, and sparsely set with variegated setæ. *Antennæ* testaceous, with the club fuscous; the funicle about as long as the club and with joint 1 as long as 2+3. *Prothorax* strongly narrowed from base to apex, almost straight at the sides, not constricted in front, very feebly sinuate on each side of the base and not emarginate in the middle, and the anterior margin of the prosternum more shallowly sinuate than usual; the disk appearing slightly pulvinate in the middle owing to a very feeble curved depression in the basal half; the setæ on the disk with their apices directed forwards, except for a narrow line of transverse setæ on each side at about the middle; the apical setæ projecting well beyond the front margin. *Scutellum* oblong-ovate, with the basal margin shallowly sinuate, clothed with setiform scales, which are sparser and dark on the basal half, and denser and pale behind. *Elytra* longer than broad (4:3), with deep, coarsely punctate striæ and uneven intervals, the striæ each with a single row of punctures, which become much reduced on the declivity; striæ 1, 2, and 4 very strongly curved outwards before the middle on a line with the black sutural patch, 3 being only slightly curved; striæ 5 and 6 merged into an irregular mass of punctures behind the middle; the intervals not broader than the striæ, convex, the uneven ones slightly higher than the others, all of them with very shallow fine punctation; interval 3 with a low elongate callus at the base, another on 5 behind the base, and a small prominence

at the apex of 5; the setæ all more or less raised and sometimes erect. *Legs* piceous, with the tibiæ red-brown and the tarsi paler, thinly clothed with subrecumbent variegated setæ, and with an indefinite dark band on the femora; the tarsal claws equal in both sexes. *Venter* with the setæ slightly broader at the sides than in the middle; the two basal ventrites flattened in the middle in ♂, but the setæ hardly differing from those of ♀.

*Length* 3–3.6 mm., *breadth* 1.8–2.1 mm.

UNITED PROVINCES: Western Almora, Kumaon (*H. G. Champion*).

Described from five specimens.

The following key will serve to distinguish the foregoing species of *Cionus* from those already known from India. *C. indicus*, Desbr., is known to me only by the inadequate description; it may possibly prove to be only an abraded specimen of *C. albosparsus* :—

*Key to the Indian Species of Cionus.*

- 1 (8). Elytra with a common black sutural patch at about one-third from the base.
- 2 (5). Basal margin of prothorax bisinuate, with the median lobe itself emarginate; elytra with the scaling uniformly disposed, the intervals all of equal height.
- 3 (4). Elytra with grey scaling, the black sutural patch without a ring of pale scales, no white sutural patch at the top of the declivity. . . . . *indicus*, Desbr., 1890.
- 4 (3). Elytra with brown scaling and scattered isolated white scales, the black sutural patch surrounded by a ring of pale scales, and a small quadrate patch of white scales at the top of the declivity; the black sutural patch extending to stria 2, stria 1 not sinuate; the antennal club longer than the funicle. . . . . [1898.  
*albosparsus*, Fst.,
- 5 (2). Basal margin of prothorax simply rounded; elytra with patches of erect scaling on the alternate intervals, which are, or appear to be, higher than the others; the anterior sutural patch extending only to stria 1, which is strongly sinuate.
- 6 (7). Tarsal claws of ♂ unequal; rostrum of ♀ with the apical portion longer than in ♂, bare, shiny, and very finely and sparsely punctate; the two basal

- joints of the funicle equal; elytra with the striæ fine and shallow, much narrower than the intervals, which are almost flat and finely punctate, but intervals 4 and 6 also bearing irregular punctures as large as those in the striæ; elytra with a second sutural black patch near the apex, the anterior one without any contiguous white patch behind it . . . . . [1875.  
*hortulanus*, Geoff.,
- 7 (6). Tarsal claws of ♂ equal; rostrum of ♀ very similar to that of ♂; joint 1 of the funicle longer than 2; elytra with the striæ broad and deep, as broad as the intervals, which are convex and all bear fine confluent punctures; the preapical sutural patch white or creamy and not black, the anterior black patch with a quadrate or elongate white or creamy patch adjoining it behind . . . . . *championi*, sp. n.
- 8 (1). Elytra without any large common sutural black patch.
- 9 (10). Scales on the disk of the pronotum lying transversely with their apices inwards, except along the middle line where they are longitudinal; tarsal claws equal in both sexes . . . . . *transquamosus*, sp. n.
- 10 (9). Scales on the disk of the pronotum lying longitudinally; tarsal claws unequal, at least in ♂.
- 11 (12). Intervals on elytra broader than the striæ; striæ 1 and 2 with a single regular row of punctures; scutellum densely clothed with broad scales that hide the integument; ♀ with the tarsal claws unequal, and with the scaling in the middle of the venter similar to that at the sides . . . . . *meleagris*, sp. n.
- 12 (11). Intervals on the elytra not broader than the striæ; striæ 1 and 2 with many punctures irregularly duplicated; scutellum with narrow scales that do not conceal the integument; ♀ with the tarsal claws equal, and with the middle of venter clothed with setiform scales much narrower than those at the sides.
- 13 (14). Scaling on intervals 2 and 4 of the elytra pale; light spots on alternate intervals yellowish . . . . . *obesus obesus*, Pasc.
- 14 (18). Scaling on intervals 2 and 4 black or blackish brown; light spots on alternate intervals white . . . . . [Aur., 1892.  
*obesus albopunctatus*,

## Subfamily CRYPTORRHYNCHINÆ.

*Osseteris sparsus*, sp. n.

♂ ♀. Integument shiny black, irregularly and variably mottled with grey and black or brown scaling above, and uniform grey beneath; the scaling not entirely concealing the integument.

*Head* strongly convex, with close reticulate punctures, each containing a recumbent scale; the forehead somewhat flattened, with a shallow median depression and some very short suberect scale-like black setæ on each side. *Rostrum* very broad and compressed dorso-ventrally, and much shorter than the pronotum; in ♂ distinctly dilated from behind the middle to the apex, with close and longitudinally confluent punctation throughout and usually with a very fine median carina; two oblique apical depressions containing the usual tufts of setæ, the dorsum covered with short broad recumbent scales, the genæ with much longer narrower ones which project at the apex, and the submentum with a median tuft of erect or suberect setæ; rostrum of ♀ not or scarcely dilated towards the apex, the punctures much finer and not confluent except at the extreme base, and the dorsal scaling also confined to the base. *Antennæ* as in the genotype; the funicle longer than the scape, joint 1 being longer than 2, and 3-7 strongly transverse and progressively widening outwards. *Prothorax* transverse (11:7), broadest at the base, slightly rounded at the sides, and broadly constricted and subtubulate at the apex, the constriction being continued across the dorsum; the base deeply bisinuate and half as broad again as apex, the postocular lobes rather small, covering only one-third of the eyes and bearing long vibrissæ; the dorsum not very convex transversely and sloping forwards longitudinally, closely set with shallow subreticulate punctures leaving a narrow irregular impunctate median line in the basal half; the scaling dense, recumbent, and grey, with two very indefinite longitudinal brown patches on the basal half of the disk, and with scattered short squamiform erect setæ. *Scutellum* subquadrate, with dense narrow pale setæ. *Elytra* subcylindrical, only slightly broader at the shoulders than the base of the prothorax, strongly convex transversely, and constricted laterally before the apex, the base being jointly and deeply trisinuate, and the projecting lobes slightly elevated; the striæ very deep and containing large subquadrate punctures, which are partly concealed by the scaling and do not



diminish behind, and striæ 3-5 curving strongly outwards at the base, striæ 5 being much deeper than the others at the base; the intervals not or but little broader than the striæ, convex, subcostate, rugulose, and set with minute shiny granules which are more numerous and prominent towards the base, interval 3 being there much dilated and somewhat raised; the scales fairly dense but scarcely overlapping, ovate, curved, and subrecumbent, but many becoming suberect on the declivity. *Legs* rugosely punctate, each puncture bearing a broad recumbent pale scale; the tooth on the femora very rudimentary; the mid-tibiæ with an obtuse angulation on the dorsal surface at one-third from the base, the hind tibiæ with short erect scales on the dorsal edge, especially at the base.

*Length* 5·7-6·6 mm., *breadth* 2·4-2·7 mm.

**SOUTH INDIA:** Nilgiri Hills (*A. K. W. Downing, H. L. Andrewes*).

Described from seventeen specimens.

*Osseteris basalis*, sp. n.

♂ ♀. Integument black and shiny, almost entirely hidden by the dense scaling, which is light brown, the elytra being irregularly mottled with dark brown, and the pronotum bearing a large quadrate median dark brown patch in ♂ and indefinite mottling in ♀.

Very similar to *O. sparsus*, sp. n., in general facies, but slightly larger and appearing more densely squamose, owing to the scales being large and mostly overlapping. Differing from the description of that species in the following characters:—*Head* without erect black setæ. *Rostrum* less dilated apically in ♂ and with a more prominent median carina; more squamose in ♀. *Prothorax* without any impunctate median line or erect setæ. *Elytra* with the striæ less deep on the disk, and the granules on the intervals less evident on account of the denser scaling; interval 3 more dilated and much more strongly raised at the base, especially in ♂; intervals 3 and 5 more raised than the others behind the middle; the structure on the declivity differing in the two sexes: in ♂ the juxtasutural striæ are narrower than the intervals and appear much shallower than in ♀, being partly obscured by the scales on the intervals, which scales are broad, recumbent, and overlapping, the clavate squamiform darker setæ being conspicuous among them; in ♀ the juxtasutural striæ are deep, much broader than the intervals and quite devoid of scaling except for the single scale in

each puncture, the scales on the intervals being comparatively narrow, erect or suberect, and closely packed. *Legs* with much denser scaling, which almost entirely conceals the integument; the femora more distinctly toothed, or rather angulated, the hind pair broad, parallel-sided, and strongly compressed; the external angulation on the mid-tibiæ forming a stout tooth (as in the genotype), the hind tibiæ also broader and more compressed.

*Length* 6·9–7·2 mm., *breadth* 3 mm.

**BENGAL:** Sunderbans, iv.–v. 1915, 2 ♂ ♂, 2 ♀ ♀ (*C. F. C. Beeson*).

The only previously described species, *O. scutellaris*, Pasc. (Journ. Linn. Soc., Zool. xi. 1873, p. 480), from New Guinea, differs from both the preceding species in its somewhat stouter build, general dark coloration above, and the conspicuous pale scutellum; the dorsal integument is opaque and finely aciculate, being entirely exposed owing to all the scales and squamiform setæ being quite erect; and interval 3 on the elytra is not dilated at the base and only very slightly elevated there.

It may be noted that Pascoc, in describing the closely allied genus *Inozetes* (t. c. p. 479), states that the funicle is 6-jointed, whereas it is really 7-jointed.

#### SYNONYMY.

Thanks to the kindness of Dr. K. M. Heller, I have been able to examine some of Faust's types, and have consequently to record the following synonymy:—

*Myloccerus (doliaris)*, Mshl., 1925) = (*Cyphicerus*) *erinaceus*, Fst., 1892.  
*Corigetus (dummersmani)*, Mshl., 1925) = *papuanus*, Fst., 1890.

Dr. Heller also informs me that *Antinia theivora*, Mshl., 1919, is synonymous with *Dermatodina vitiosa*, Fst., 1895. I can find no satisfactory characters to separate *Dermatodina*, Fst., 1895, from *Antinia*, Pasc., 1871, and therefore treat the former as a synonym. The species will stand as *Antinia vitiosa*, Fst.

#### LII.—*Papers on Oriental Carabidæ*.—XVII.

By H. E. ANDREWES.

THROUGH the kindness of Mr. G. Severin of the Brussels Museum, I have been enabled to see the types of all the Eastern species of *Clivina* and *Dyschirius* in the Putzeys Collection, and I take this opportunity of thanking him for

his courtesy. I am also indebted to Dr. G. Schröder of the Stettin Museum, who has been good enough to send me a number of specimens from the Dohrn Collection, including some of Putzeys' types, to Dr. Gestro, who has placed at my disposal the valuable material in the Genoa Civic Museum, and to Mr. Lesne of the Paris Museum, who has sent me two of his own types for examination. The four species of *Clivina* described by Mr. Lesne in the 'Mission Pavie' are all quite distinct, and I need not further refer to them here. At the end will be found a few observations on the genera *Coryza*, *Ancus*, and *Psilus*.

In the following pages I shall also allude to specimens in the Chaudoir Collection, now forming part of Mr. René Oberthür's collection. A good many of Putzeys' types are to be found in this, and I regret that when I was at Rennes the time at my disposal did not enable me to examine them at all thoroughly; though I did not see all of them myself, I have little doubt that the whole of the types of species described as coming from Chaudoir will be found there.

I am not incorporating any references to former papers of my own, but some notes on *Clivina* types will be found in the 'Transactions of the Entomological Society of London,' 1919 and 1921, and in the 'Annals of the Genoa Civic Museum,' 1922.

### Genus *CLIVINA*.

I do not propose here to deal with generic characters, but to give some account of the specimens in the Putzeys Collection, more especially from the point of view of synonymy. As in some other genera I think that here, too, Putzeys has looked upon species as usually confined to relatively small areas, so that when, for example, he had before him specimens, often unique, from different parts of the Malay Archipelago, he regarded their individual characters as of specific importance. This has led to the multiplication of species, which facts do not seem to me to warrant. In this genus the individuals of each species are subject to considerable variation. Within reasonable limits I regard size and even colour as of relatively little importance, and in this I am following so good an authority as Mr. T. G. Sloane (Proc. Linn. Soc. N.S. Wales, 1896, p. 150). The sculpture of the upper surface of the head is one of the most important characters, but even here there is no constancy, and I may quote Bates, who says "the singular sculpture of the surface of the head in the genus *Clivina*, though constant

in ground-plan, is subject to considerable individual variation in the species" (Ann. Mus. Civ. Gen. 1892, p. 278), a view with which I quite agree.

Putzeys' Monograph of the genus was published in 1846 (Mém. Liège, vol. ii.), and this was followed by the "Postscript" in 1863 (Mém. Liège, vol. xviii.). The "Révision Générale" appeared in the 'Annals of the Belgian Entomological Society' in 1867 (vol. x.), the first Supplement in the same periodical in 1868 (vol. xi.) and the second Supplement in 1873 (vol. xvi.). Some further descriptions of species sent by Dohrn appeared in 1877 (vol. xx.), and a few species of *Dyschirius* were described in 1878 (vol. xxi.).

The "Révision Générale" is perhaps the most important of these works, because in it the author attempted a classification and divided the species into no less than thirty groups. Only a few of the groups are concerned with Oriental species, and these I propose to go through in order, offering such comments as seem desirable:—

GROUP I.—*C. assamensis*, Putz., *indica*, Putz. (= *rugosifrons*, Nietn. = *recta*, Walk.), and *memnonia*, Dej., are rightly included in this group. The types of the first two are in the Hope Department of the University Museum at Oxford, that of *rugosifrons* is no doubt in the Zool. Mus. at Berlin, that of *recta* is in the British Museum, and that of *memnonia* at Rennes. I formerly considered *indica* as distinct from *memnonia*, but now think them the same; *assamensis*, however, must be regarded as a separate species on account of the unusual form of the mentum.

The remaining Eastern species, *C. westwoodi*, Putz., is placed quite erroneously in this group, but I must also include here *truncata*, Putz., and *costulipennis*, Bates, which are closely allied. Bates's type is in the Genoa Civic Museum and, as *truncata* was described from three examples taken by Dr. Beccari in Amboina, the type should be there too, but is missing; there is, however, a cotype at Brussels, and there are other examples at Genoa from Engano I. and the Mentawai Is. Putzeys described *westwoodi* (= *castanea*, Putz., not Westw.) in the Postscript, and included two specimens, one from Ceylon and the other from New Guinea, belonging to different species, and both now in the Putzeys Collection at Brussels. As the description fits the Ceylon better than the New Guinea specimen, I propose to retain for it the name of *westwoodi*, and hope before long to deal with this and other species from the Indian region. The New Guinea specimen is identical with *C. wallacei*, which,

as Putzeys' description is quite inadequate, I redescribe below.

*Clivina wallacei*, Putz.

Length 5.25 mm. Deep piceous-red, disk of elytra darker; palpi, antennæ, and legs more or less ferruginous. *Head* with median part of clypeus bordered and slightly emarginate, hardly in front of or separated from wings, a slight notch before frontal plates; clypeal ridge curved (convex forwards), more distinct at sides, suture formed by a vaguely rugose transverse depression between it and front, a large pore on vertex, facial sulci deep, joining neck-constriction, which is punctate, deep at sides, but just interrupted in middle, surface microscopically punctate; labrum 6-setose, mandibles short and wide, mentum swollen at base, the tooth barely shorter than the lobes; antennæ with joints 2 and 3 about equal, moniliform from joint 4. *Prothorax* quadrate, as long as wide, sides nearly straight, faintly rounded and contracted in front, a small tooth at hind angles; median line fairly deep, reaching front transverse impression, which is rather shallow, but uninterrupted, and reaches front margin at extremities, surface with a few vague scratches only. *Elytra* fully twice as long as wide, convex, parallel, a small tooth at shoulder; striæ vaguely crenulate, deep at base, much shallower on apical half, 1 to 4 free at base, 5 joining 6, 7 terminating behind shoulder, striae very slight; intervals convex near base, flatter behind, 3 with four pores adjoining stria 3, 8 carinate at apex, but not behind shoulder. Prosternal ridge only moderately narrow, sulcate in front, pores on each side of last ventral segment distant; protibiæ 3-digitate. (including apical digitation), mesotibiæ with a spur a little above apex.

The labrum is 6-setose, as in *memnonia*, whereas in *west-woodi* (Ceylon ex.) it is 7-setose; otherwise the new species is more like the latter. It differs in having a slight blunt projection only, instead of a sharp tooth, at each end of median part of clypeus, the front less rugose, the neck-constriction interrupted, the surface of prothorax without any figure Y at sides, the elytral striæ much deeper near base. The species is referred to again under Group VIII.

GROUP II.—Three species are included in this group, *attenuata*, Herbst (= *picipes*, Bon. = *melanaria*, Putz.), *sulcigera*, Putz., and *striata*, Putz. The type of *attenuata* is presumably in the Berlin Zool. Mus., an example (doubtfully the type) of *picipes* is in the Turin Zool. Mus., the types of

*melanaria* and *striata* are at Oxford, and that of *sulcigera* at Rennes. There are two examples of *striata* at Brussels.

*C. sulcigera*, apart from its smaller size, presents no characters to differentiate it from *attenuata*; this form occurs chiefly in Siam and Indo-China. *C. striata*, though closely allied, appears to be distinct.

GROUP III.—Of eastern species only *vulgivaga*, Boh. (= *humilis*, Moraw.), and *extensicollis*, Putz., are included. The types of the two former, which I have not seen, I believe to be in the Zool. Mus. at Stockholm and the Museum of the Petrograd Academy respectively. The type of *extensicollis* was unique, it came from Java, and Putzeys expressly tells us that it was in his own collection. There are now two examples of the species at Brussels, neither of them labelled as *extensicollis*, but both with the locality-label "Calcutta." I think there is some mistake here, as I believe the species to be confined to the Malay Archipelago. There is also a specimen at Rennes. The whereabouts of the type is consequently a matter of uncertainty.

GROUP VIII.—After examining the Putzeys specimens and a great deal of other material, I am unable to differentiate by any substantial characters quite a number of them which he treated as separate species. The synonymy in this group appears to be as under:—

*C. lobata*, Bon. = *hydropica*, Putz. = *angularis*, Putz. = *capitata*, Putz. = *divaricata*, Putz. = *anceps*, Putz., and to these I may add the more recently described *laviceps*, Bates.

*C. sabulosa*, MacL. = *advena*, Putz. = *humeralis*, Putz.

*C. helferi*, Putz., stands by itself in the "Révision," but as synonyms there must be added *grammica*, Putz., and *debilis*, Bates (= *invalida*, Andr.).

The following I regard as good species:—*elongatula*, Nietn., *javanica*, Putz., *siamica*, Putz., *transversa*, Putz., *brevior*, Putz., and *wallacei*, Putz.; the remaining species, *stricta*, Putz., I refer to below. To this list must be added *dolens*, Putz., and *mærens*, Putz., described at a later date, both nearly allied to *lobata*, but perhaps sufficiently distinct to retain as species.

The type of *lobata* is at Turin, those of *angularis* and *anceps* at Brussels, those of *hydropica*, *capitata*, and *divaricata* at Rennes, that of *laviceps* at Genoa. Dejean's *lobata* is identical with Bonelli's, and came from the same source: the type of this is at Rennes, and examples at Oxford and Brussels are apparently cotypes. There are at Brussels cotypes of *hydropica* and *divaricata*.

as the type of *sabulosa* is in the British Museum, that of *humeralis* at Brussels, that of *advena* at Rennes, but a cotype of the last-named is at Brussels.

Putzeys described *helferi* on two specimens sent by Schaum; one of these—presumably the type—was no doubt returned to Schaum, and should therefore be in Berlin, the second specimen remaining in Putzeys' Collection. The type of *grammica* is in the Stettin Zool. Mus., with a cotype at Brussels; that of *debilis* is at Genoa; *invalida* was only a *nom. nov.*

The type of *elegantula* is presumably in the Berlin Zool. Mus.; a specimen of *javanica* at Oxford is possibly the type, but there is an example at Brussels; there are examples of *siamica* at Brussels, Oxford, and Genoa, all apparently taken by Castelnau at Bangkok, but, as his collection is at Genoa, I think one of the specimens there must be regarded as the type. With regard to *stricta*, the unique type came from Java, and, having been presented to Putzeys by Riehl, should be at Brussels; examples of other species received from this entomologist always bear his name on the label, but the alleged type of *stricta* is labelled "Pedong" only, and, as the specimen does not agree with the description, it is clearly not the type, which is apparently lost. The example, which is not actually labelled "*stricta*" by Putzeys, seems to be a specimen of *extensicollis*, and, if Pedong is in Java (I cannot identify it from the map), might even be the type of that species. The only Pedong known to me is in Sikkim, but possibly the name should read Padang in Sumatra.

*C. transversa* was described on a unique example from Siam sent by Signoret, and, if his collection was subsequently acquired by Chevrolat (regarding which I know nothing), the Oxford example is probably the type. There is also a specimen at Brussels, and there are several at Genoa, all taken by Castelnau at Bangkok. The unique type of *brevior* is at Rennes. *C. wallacei*, like *helferi*, was described from two specimens sent by Schaum, one of which, I suppose the type, was no doubt returned and is now in Berlin, the other remaining in Putzeys' Collection. There were, however, two further examples in the Chaudoir Collection, now at Rennes, and there are specimens in the Genoa Museum from Kaju Tanam in Sumatra. The species is redescribed above. The types of both *dolens* and *mærens* are at Brussels.

GROUP IX.—There are only three species in this group,

*parryi*, Putz. (= *castanea*, Westw. = *Eupalamus clivinoides*, Schm.-Goeb., in litt. fig.), *lata*, and *agona*. Like Bates I cannot find any difference between the two former, and *agona* at most is only a slight variety with the prothorax punctate.

The type of *parryi* is at Brussels, of *castanea* in the British Museum, of *lata* at Rennes, with a cotype at Brussels, of *agona* at Oxford. An example at Brussels, and several examples at Genoa, labelled *agona* by Putzeys, are of the typical form, not the variety. Schmidt-Goebel figured, without describing, his species, and there is no specimen in the Helfer Collection at Prague specially indicated as the example from which the figure was drawn.

GROUP X.—In this group we reach the high-water mark of synonymy. In addition to *rufipes*, Motch., Putzeys includes here seven of his own species (*obesicollis*, *convexicollis*, *foveicollis*, *marginicollis*, *mordax*, *placida*, and *stigmatica*). I look upon all these as the same species, and I have examined types or cotypes of all of them, but it must bear an even earlier name, viz., *tranquebarica*, Bon., and I may add one further synonym, *scuticeps*, Bates. The nearly allied Japanese species, *niponensis*, Bates, seems distinct, as is also a later species of Putzeys, *semicarinata* (= *occipitalis*, Bates).

Motchulsky's Collection is understood to have perished, and I was unable when at Brussels to find the example of *rufipes*, which Putzeys tells us was sent to him by the author: it seems highly probable that it is the same thing as *tranquebarica*, of which the type is at Turin. Of Putzeys' seven species the types of five are at Brussels, those of *marginicollis* and *placida* being at Rennes; there is a cotype of *marginicollis* at Brussels. The types of *scuticeps* and *occipitalis* are at Genoa, that of *niponensis* in the British Museum, and that of *semicarinata* at Stettin, with a cotype at Brussels.

GROUP XI.—This contains only one species, *bengalensis*, Putz. (= *pluridentata*, Putz. = *scissa*, Bates). The type of *bengalensis* is at Rennes, and of *scissa* at Genoa. The type of *pluridentata* should be at Stettin, but is missing; there are, however, two cotypes at Brussels.

GROUP XXVIII.—One Oriental species only, *ephippiata*, Putz., the type of which is at Oxford.

#### Genus *Dyschirius*.

Putzeys described fifteen species of *Dyschirius* from the



Oriental region, but the majority of the descriptions appeared after the publication of the "Révision." Examples of seven of these species were sent to Putzeys by Dohrn, and presumably all the types were returned; Dohrn's Collection is now in the Stettin Museum, and these seven types, three of them unique, should be there. Dr. Schröder informs me that actually only two types are to be found, viz., those of *porosus* and *schmidtii*, and I found cotypes of both at Brussels. The remaining five types are therefore lost, viz., *binodosus*, *fuscus*, *rugifer*, *nitens*, and *verticalis* (= *æneobrachialis*, Bates); the first three of these were unique, but cotypes of the last two are at Brussels. Bates's type, which I have compared with the cotype of *verticalis*, is at Genoa.

Of the remaining eight species—viz., *doriæ*, *indicus*, *orientalis*, *ovicollis*, *stenoderus*, *interpunctatus* (= *Oxydrepanus birmanicus*, Bates), *impunctatus*, and *hispidulus*, the types of *indicus*, *interpunctatus*, and *hispidulus* are all no doubt at Rennes, cotypes in each case being at Brussels; the types of *orientalis*, *ovicollis*, and *stenoderus* are at Brussels; the types of *impunctatus* (cotype at Brussels) and *birmanicus* are at Genoa. The type of *doriæ*, which should be also at Genoa, is missing, but there is a cotype at Brussels.

It remains to be seen whether it will be possible in the future to identify any of the three species of which the unique types are lost. Of the twelve species of which I have examined either type or cotype, the following appear to be distinct:—*porosus*, *nitens*, *verticalis*, *doriæ*, *indicus*, *orientalis*, *ovicollis*, and *stenoderus*. There remain four species, of which *interpunctatus* was first described; I cannot differentiate from it either *schmidtii* or *Oxydrepanus birmanicus*. In this species intervals 3 and 4 are seriate-punctate, whereas in *impunctatus* all the intervals are impunctate, and in *hispidulus* all (except the sutural interval) are punctate; I do not notice any other differences and therefore for the present treat these two forms as varieties of *interpunctatus*. Putzeys identified with the species the figure of *Phreoryctes pusillus*, Schm.-Goeb., in litt. (= *Dyschirius debilis*, Putz., nom. nov.), in the 'Faunula Coleopterorum Birmanicæ'; a comparison of the type of *interpunctatus* with the figure renders this supposition extremely improbable. Bates, relying chiefly on the form of the maxillary palpi, put his *birmanicus* into Putzeys' genus *Oxydrepanus*, otherwise known only from tropical America; in spite of the dissimilarity in the upper surface of the head, *interpunctatus* and its allies agree so well with the American species in colour, facies,

and some other characters that they are certainly better placed in *Oxydrepanus* than in *Dyschirius*.

When Bates was examining Mr. George Lewis's Japanese material (Trans. Ent. Soc. Lond. 1873, p. 241), he misidentified *orientalis*, Putz., at the same time briefly describing the specimens he had before him; immediately following, and by reference to the supposed *orientalis*, is the description of a new Japanese species under the name of *hiogoensis*. *D. orientalis*, Bates, which I have compared with Putzeys' type, is a little smaller, the head narrower, the clypeal suture and facial sulci taken together not presenting (as they do in *orientalis*) a deep horseshoe-shaped depression, prothorax similar in shape, elytra much more globose, with the shoulders obsolete, the striæ and punctures in them much finer. I propose for this species the new name of *batesi*: Bates has already indicated the comparatively slight differences which separate it from his own *hiogoensis*. The type is in the British Museum.

On the previous page of the same paper Bates described another Japanese species under the name of *D. ordinatus*. In the description the third interval of the elytra was said to be impunctate, but Putzeys suspected that "impunctato" was a misprint for "tripunctato," in which he was correct. When Bates was dealing with the Carabidæ taken by Mr. George Lewis in Ceylon (Ann. & Mag. Nat. Hist. (5) xvii. 1886, p. 73), he identified a solitary example of *Dyschirius* taken at Kandy as his own *ordinatus*, observing "I can discover no difference of specific importance between a Ceylonese example and others taken by Mr. Lewis in Japan." To me the two species appear very dissimilar, and I describe the Ceylon example below under the name of *D. singhalensis*.

Once again, in 1891 ('Scientific Results of the Second Yarkand Mission, (Coleoptera,' p. 4), Bates determined a species from the Pamir as his own *ordinatus*. I have seen a single specimen of this in the collection of the Indian Museum, unfortunately without a head, and, though Bates does not expressly say so, I imagine that it was unique. I feel little doubt that the determination is erroneous, but in the circumstances am unable to suggest any emendation. Should there prove to be a second example in the Bates Collection, now at Rennes, it may be possible to clear up this point on some future occasion.

*Dyschirius singhalensis*, sp. n.*Dyschirius ordinatus*, Bates, 1886 (not Bates, 1873).

Length 3 mm. Head and prothorax brassy-black ; elytra brassy ; joints 3 to 11 of antennæ, profemora, and tibiæ piceous ; joints 1 and 2 of antennæ, palpi, mandibles, protarsi, and middle and hind legs ferruginous.

*Head* with clypeus bordered, truncate in middle, sides porrect, clypeal elevation convex, transverse, somewhat produced at sides, suture very deep, facial sulci deep, curved, extending from the point where front margins of clypeus and frontal plates meet to back of eye, labrum moderately emarginate, mandibles wide and projecting, eyes rather prominent, antennæ short, moniliform, surface smooth, rugose-punctate outside facial sulci. *Prothorax* subglobose, rather transverse, bordered throughout, the transverse sulci at extremities deep, median line fine but distinct, surface smooth. *Elytra* short, ovate, a little wider than prothorax, shoulders rounded, no basal border, a large pore on each side of scutellum unconnected with the striæ ; striate-punctate, the punctures moderately deep, none of them reaching base, 1 only reaching apex, the rest evanescent on apical fourth, 7 fine, 8 just indicated, apical striole fairly deep, intervals nearly flat, 3 tripunctate, marginal channel with two rather vague setiferous pores behind shoulder, protibiæ with only a trace of a denticulation along outer margin.

Nearly allied to *lafertei*, Putz., but with a deeper clypeal suture and more prominent eyes, the prothorax more transverse, the elytra shorter and more oval, a little more finely striate. The species is about the size and colour of *orientalis*, but the sculpture of the head differs, the elytra are more oval, with the shoulders cut away, the punctures in the striæ not quite so deep, the apex not yellow.

Kandy, 1 ex. in the British Museum.

## Genus CORYZA.

Three species are included in Putzeys' 'Révision,' viz. *maculata*, Nietn., *nietneri*, Putz., and *cariniceps*, Putz. ; to these must be added *chlorizans*, Bates (described as a *Clivina*). Whether these are all distinct species I am not yet in a position to decide. The type of *cariniceps* is at Rennes, with a cotype at Brussels, and that of *chlorizans* at Genoa. The type of *nietneri* was said by Putzeys to be in his own collection, and may possibly be found there, but I was unable, when at Brussels, to discover it. A specimen

claiming to be the type of *maculata* is at Stettin, and this is evidently the example from the Dohrn collection mentioned in the 'Révision'; I think it probable that the type is actually in the Berlin Zool. Mus.

#### Genus ANCUS.

There is only one species, *A. excavaticeps*, Putz., and the author had before him examples from Chaudoir, Signoret, and Chevrolat. Probably these specimens all came from Castelnau, though his name is not mentioned. There is also a series of specimens in the Castelnau Collection at Genoa, not apparently forming part of those from which the description was prepared, and there are other examples at Brussels. It would seem probable that either a specimen at Rennes or one of those at Oxford should be regarded as the type.

#### Genus PSILUS.

Putzeys described only one species, *P. acutipalpis* (1877). Both genus and species were described on two specimens received from Dohrn, and in the descriptions were said to come from Calcutta. The type is in the Stettin Museum, the cotype at Brussels; both are labelled "Birma," and one of them "Helf." (= Helfer).

A second species was described by Bates (1889) under the name of *Clivina trapezicollis*, though he recognised later on that it belonged to the genus *Psilus*; the type is now in the Paris Museum (Coll. Fleutiaux). When commenting on this in 1921, I suggested that Putzeys' *Ardistomis paradoxus* (1868), placed by him very reluctantly in the genus *Ardistomis*, might prove to be a *Psilus*, and possibly be identical with Bates's species, but I had no idea at that time where the type was to be found. I have now seen it in the collection of the Genoa Civic Museum, and find that both my conjectures were correct. A further comparison with the type and cotype of *acutipalpis* does not reveal any greater differences than are often met with in some of the species of *Clivina*, and I believe that these three species are really one and the same, which should bear the oldest name of *paradoxus*. Presumably Putzeys, after the lapse of eleven years, and with the type of *paradoxus* no longer before him, had forgotten, when he came to describe the genus *Psilus*, what it looked like, and accordingly makes no mention of it.

LIII.—*On the Occurrence of the Jurassic Fern, Laccopteris, in North Africa.* By W. N. EDWARDS.

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APART from the Coal Measure flora of the Sud-Oranais, and various late Tertiary and Pleistocene leaf-impressions, very few fossil plants are known from Algeria. It is therefore of interest to record the occurrence of the Matoniaceous fern *Laccopteris* in rocks of Sequanian age near the Algerian-Moroccan frontier at Djebel Khorchef.

I have to thank Prof. J. Savornin and Dr. F. Ehrmann of Algiers for the opportunity of examining the material, which consists of several portions of both sterile and fertile fronds in a red shale. One specimen (V. 17488) has been presented to the Geological Department of the British Museum (Nat. Hist.). The fronds belong to the section of *Laccopteris* which includes the closely-related species *L. polypodioides*, *L. woodwardi* (Middle Jurassic), and *L. dunkeri* (Kimmeridgian and Wealden), but they seem to be quite distinct, and are therefore described as a new species, which may be called

*Laccopteris densa*, sp. n.

*Diagnosis.*—*Laccopteris* fronds with narrow pinnules, parallel and closely crowded together; the rows of small sori centrally placed between the midrib and the margin of the frond (see text-figure).

*Horizon.*—Upper Jurassic, Sequanian.

*Locality.*—Djebel Khorchef, Oudjda, near Algerian-Moroccan frontier.

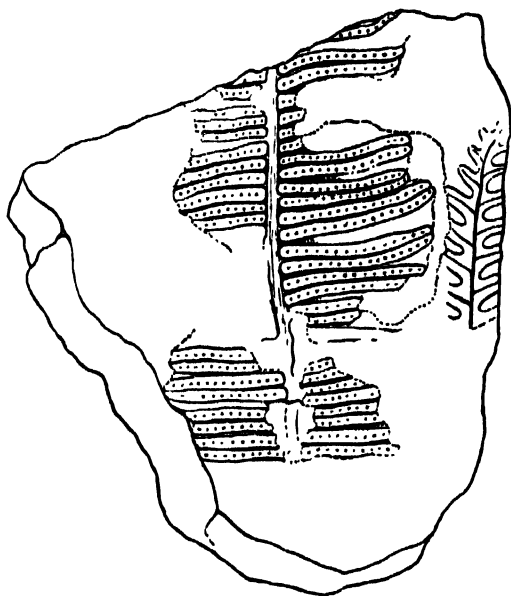
Among the numerous fragments there are two small pieces only (one of these is shown in the text-figure) in which the pinnules are not crowded; they are probably tips of fronds or, perhaps, young fronds. The pinnules are usually 2–3 mm. in width, the broadest being 4 mm. The longest pinnule was only 2 cm. in length, and the species is therefore smaller as well as more compact than those mentioned above. The pinnules are bluntly rounded at the tip, and not appreciably widened at the point of attachment to the rachis.

In one or two places the close network of veins can be seen, very similar to that of *L. woodwardi* (cf. Seward, 1900,

'Jurassic Flora,' pt. 1, p. 85, fig. 11 c) and *L. dunkeri*, but closer than in *L. polypodioides*. The details of soral structure are, unfortunately, not shown; the sori are smaller and not so close to the midrib as in *L. woodwardi* and usually in *L. dunkeri*.

No other plants are associated with the *Laccopteris*, except an unidentifiable fragment of a ribbed stem.

The genus *Laccopteris*, which had not previously been



*Laccopteris densa*, sp. n. Upper Jurassic, Djebel Khorchef, near Oudjda. Natural size.

found in Africa, was widely spread in Europe in Mesozoic times, ranging from the Rhætic to the Lower Cretaceous. It has recently been shown by Prof. A. C. Seward ("Notes sur la Flore Crétacique du Groenland," Livre Jubilaire de la Soc. Géol. de Belgique, 1925, p. 238) that Heer's genus *Nathorstia*, which has been described from Greenland, Patagonia, and Queensland, was almost certainly not Marattiaceous, and is indistinguishable from *Laccopteris*.

LIV.—*Descriptions of new Species of Rhopalocera from the Ethiopian Region.* By G. T. BETHUNE-BAKER, F.L.S., F.Z.S.

### Nymphalidæ.

#### ACRÆINÆ.

*Acraea althoffi*, Dew., *bitjana*, forma nov.

♂. Upperside: primaries with the red area in the cellular and median areas much greater and brighter than in the type, caused by the dark band being decidedly narrow and more broken; the subapical spot is also quite bright red like the rest of the wing with no yellowish shading at all.

♀. Similar to type.

Type in my collection.

*Hab.* Bitje, Cameroons.

This is evidently the form obtaining in this part of the Cameroons. I have several specimens, and I have seen it in other collections also.

#### NYMPHALINÆ.

*Deistogyna batesana*, sp. n.

♀. Upperside: both wings brown with pale ochreous stripes. Primaries with the usual marks in the cell and basal area just traceable; a very broad pale ochreous stripe in the postmedian area, very oblique, increasing in width from the costa to vein 2 where it nearly reaches the termen, from vein 2 it is continued from its basal angle in a waved line to the inner margin; there is a curved series of four white subapical dots from the costa. Secondaries with a central transverse pale ochreous narrow stripe from the costa into the abdominal fold, which is followed in the postmedian area by two subcrenulate stripes, rather indefinite and well separated, enclosing, so to speak, broad large spots of the ground-colour, beyond which is a very indistinct trace of a narrower subterminal line.

Underside: both wings pale brownish grey. Primaries with the upperside pattern repeated, except that the four subapical white dots became indefinite pale cloudy dashes. Secondaries with numerous transverse stripes; a pale grey subbasal broad band with a dark dot in the cell, followed by a broad dark brown band which is sharply defined outwardly and edged by a very pale broad stripe, which is followed indefinitely by a broader pale brownish band increasing in depth of colour and ending externally definitely, but being slightly curved; beyond this is a very broad pale area in which are large cordate interneural indefinite spots, this pale area is terminated by a crenulate submarginal stripe, beyond which the area is darker.

Expanse 64 mm.

*Hab.* Bitje, Cameroons, 2000 ft. (G. L. Bates).

Type in my collection.

This species is not very near anything; it is perhaps nearest to my *D. luteostriata* from the Congo, but both the upperside and the underside are quite different, and it should be easily recognisable from the description and especially from the prominent and peculiar ochreous oblique band of the primaries.

*Cymothoë zombana*, sp. n.

♂. Upperside: both wings black with cream-coloured markings. Primaries with a triangular cream patch in the costal and median area, occupying the outer two-thirds of the cell, extending into the postmedian area down to vein 2; a waved subterminal submarginal series of sagittate marks, the apex itself having a small creamy-grey spot intersected by vein 8. Secondaries with a subtriangular cream patch having a curved outer edge, occupying the outer half of the cell and about a third of the postmedian area, with a submarginal series of cream lunules tending to disappear towards the anal angle.

Underside: both wings ochreous cream with the usual pattern of the genus, with the submedian transverse line fine and definite and almost vertical, not oblique. In the primaries the area outside the vertical postmedian line is pale brownish with the sagittate marks of the upperside faintly indicated in the dark cream-colour, and the same applies to the secondaries except that the darker area is not immediately contiguous to the vertical line.

Expanse 60 mm.

*Hab.* Zomba, Nyassaland.

Type in the British Museum. 1 ♂.

The species is so distinct that there can be no doubt as to its being new; it is allied to *alcimeda*, Godart, but the pattern above is entirely different, and, whilst it is a male, it has assumed more or less the female dark colouring.

*Cymothoë melanjæ*, sp. n.

♂. Upperside: both wings black with reduced very pale creamy-white median areas and the usual submarginal sagittate series of spots. Primaries with the triangular white patch greatly reduced and lying across the middle of the cell, scarcely extending to the end of the cell and with the spot across the cell darkly outlined, between the end of the cell and the submarginal white lunules there is a white costal ill-defined spot. Secondaries with a median white band something similar to the previous species, but not triangular and very much reduced in width, and with the lower spots of the submarginal series reduced to little more than dots.

Underside: both wings similar generally to the preceding species, but with the transverse line less vertical, inclined to be waved, broader and less defined, and with a narrow external dark irregular stripe, edged by a postmedian series of pale lunules; including this



there are three series of these pale lunules, the submarginal one having a fine internal dark edging.

♀. Both wings less black and with white postmedian transverse bands right across the wings. Primaries with the white stripe starting from the costa just beyond the cell, inclined outwards into a broad white stripe in the radial area, and descending irregularly to the inner margin; the submarginal lunular series very irregular and somewhat evanescent and with exterior black indistinct inter-neural spots. In the secondaries the white band is more like the male, but narrower, with the internal margin straighter and more defined, and continued through almost into the anal angle.

Underside: with the white pattern above showing through much more prominently than in the male, the vertical postmedian dark stripe reduced in width to little more than a line in the primaries. In the secondaries the vertical dark line has the white stripe of the upperside showing through as an external border to it. The general colour of both wings is browner than in the male.

Expanse, ♂ 68, ♀ 72 mm.

*Hab.* Nyassaland into Melanje.

Types in the British Museum (*Neave*); a long series.

*Cymothoe vumbui*, sp. n.

♂. Upperside: both wings blackish with white markings. Primaries with a large white patch across the cell near its end, beyond the cell a series of five white spots below each other, those near the costa being the largest, the fourth being the smallest, it is very small in comparison with the others; beyond this the black area is very defined, and in it is a series of submarginal white lunules with black pupils or near the apex black sagittate markings, the apex is restrictedly whitish. Secondaries with the median area very broadly whitish, submarginal and marginal areas almost as in the primaries.

Underside: both wings creamy white with a blackish defined transverse broadish line right across the wing. Primaries with the spots of the upper surface outlined below. Secondaries with the upperside pattern showing through in a similar way.

Expanse 68 mm.

*Hab.* Vumbu Mountains, 6500 ft., S. Rhodesia.

Type in my collection (*R. Stevenson*); other specimens in Mr. Stevenson's collection.

I have to thank Capt. Stevenson for this type, which he took near Umtali, on the Vumbu Mountains. It is allied to the previous species.

**Lycenidae.**

*LIPTENINÆ.*

*Telipna neavei*, sp. n.

♂. Upperside: both wings blackish brown with tawny-red

areas. Primaries with a broad wedge-shaped patch in the postmedian area and slightly invading the median area, and above it a small subapical spot of the same colour. Secondaries tawny-red from base to about a third beyond the cell.

Underside: primaries with the pattern of the *acræa* type, costa broadly black with three whitish or very pale creamy large spots in the cell and five open spots beyond, including the small apical one; termen from vein 5 broadly black with pale yellowish-white interneural spots, the tawny upperside patch showing through, but paler and larger, and very much paler, almost yellowish, in the subapical area. Secondaries pale yellowish, scarcely tawny at all, with a small basal black spot, six costal vertical spots and dashes, a subbasal black spot below the cell, terminal black border similar to *acræa*, but the inner black margin "stepped" sharply between each vein, not curved as in that species.

♀. Upperside: both wings with the tawny areas paler and very much reduced and the subapical spot more separated.

Underside like the male.

Expanse, ♂ ♀, 48 mm.

*Hab.* Budongo Forest, Unyoro, 8400 ft. (*Neave*).

Types in the British Museum. A good series.

This species is in the *acræa* section, but can be easily separated both by the upperside and underside pattern.

*Telipna sheffieldi*, sp. n.

♂. Upperside: both wings blackish brown with reddish areas. Primaries with a suboval spot occupying the postmedian and a part of the median areas, above it a large broad subapical transverse reddish bar, but slightly separated from the suboval patch. Secondaries with a very restricted black base and a very broad blackish termen, the intervening area being reddish.

Underside: primaries with the costa pale lemon-yellowish with six broad black vertical irregular dashes, the sixth being L-shaped, a subapical costal black patch with three pale lemon small spots in it, below the L-mark is a small black spot; from vein 5 the termen is broadly black, but the interneural spaces are nearly filled with large oval yellowish spots. Secondaries very much as in the previous species, but the terminal spots very large.

♀. Similar to the male, but with the black areas increased.

Expanse, ♂ 48, ♀ 49 mm.

*Hab.* Durro Forest, Mpanga Forest (Toro), 4500-5000 ft. (*Neave*).

Types in the British Museum. A long series.

This species is allied to *neavei*, but is a larger species and it is easily separated by the pattern. I have named these two after Mr. Neave, their discoverer, to whom so much is due for the many discoveries in his various African trips.

*Telipna venanigra*, sp. n.

♂. Upperside: both wings black. Primaries with a dull red

area restricted to the basal two-thirds of the fold and the basal half of the interspace between veins 2 and 3; in this area veins 1 and 2 are outlined in black. Secondaries with the red area restricted to a little over half—the basal half—of the wings.

Underside: of the *bimacula*-type of pattern. Primaries very similar to *bimacula*, but less accentuated and with the white spots and interspaces much less prominent, and the same applies to the secondaries. Whilst the upperside is much darker, the underside is paler and much less coloured. It is also a decidedly smaller insect than *bimacula*.

Expanse 46 mm.

*Hab.* Bitje, Cameroons (*Bates*).

Type in my collection. 2 ♂ ♂.

*Telipna erica ugandæ*, forma nov.

♂ ♀. Upperside: both wings yellowish orange, not deep red as in the typical race (West African), with the white marginal spots less large and less prominent and the orange area decidedly larger than in the type, this being brought about by a reduction of the black areas.

Underside: as in *erica erica*, but with the prominent internal row of white spots not extending beyond vein 4; in the type it extends right round the wing to the costa. The form is also decidedly larger than the West African specimens.

Expanse, ♂ 52, ♀ 60 mm.

*Hab.* Toro, Uganda Protectorate (*Neave*), also Uganda (B.M.); also Mulange, Uganda (*Joicey Coll.*).

Types in the British Museum. A considerable series.

*Telipna ja*, sp. n.

♂. Upperside: both wings black with red areas. Primaries with a deep tawny-red area on the inner margin extending just into the cell and for the basal third of the interspace between veins 2 and 3. Secondaries with the basal, the median, and postmedian areas deep tawny-red. The fringes of both wings have white dots, one between veins 1 and 2, 2 and 3, and 3 and 4.

Underside: deep tawny-orange in both wings with black and white markings. Primaries with the costa divided up into seven large black patches divided by small narrow white dashes, the fifth black patch having another large black spot below enclosing the white dash between it and the following black patch, costa with small white spots in addition and two subapical white spots also, termen narrowly black to vein 3, where the tornal black area suddenly expands nearly meeting the black spot below the fifth patch. Secondaries with five irregular broad black dashes divided by narrower white dashes, the usual very broad "stepped" black terminal and inner marginal border with two rows of white spots; a small black subbasal spot below the cell.

♀. Similar to the male, but the upperside in the primaries is

with the red area extending up to the costa for its basal half and with a subapical transverse bar of three white spots; the secondaries with three or four white interneural marginal spots in the tornal area, the white intersection of the fringes more pronounced; the underside is as in the male.

Expanse, ♂ 45-48, ♀ 54 mm.

*Hab.* Bitje, Ja River, Cameroons (*Bates*), and Gaboon.

Types in my collection, 2 ♂♂ and 1 ♀; also in the Joicey Collection, and 1 ♀ from the French Gaboon.

This belongs to the *fervida* section, and may eventually be found to be a local race of that species, but it is separable at a glance from it.

*Larinopoda batesi*, sp. n.

♀. Both wings white, rather creamy. Primaries with a very broad blackish costa and a broader blackish apex and termen. Secondaries with the termen very broadly blackish. Underside similar to the upperside, but in the secondaries there is a defined black spot at the end of the cell and the dark margin is continued right along the abdominal fold.

Expanse 48 mm.

*Hab.* Bitje, Cameroons (*G. L. Bates*).

Type in my collection.

There should be no difficulty in identifying this species with its very broad dark borders and central black spot at the end of the cell, making it different to all others; it is nearest to *L. aspidos*, Druce, but the white area is quite different in shape and there is no trace of any of the usual spots on the under surface, and there is the spot in the quite unusual place, viz. at the end of the cell.

*Liptena citronensis*, sp. n.

Upperside: both wings pale creamy lemon-yellow. Primaries with the costa finely grey to about the end of the cell, when it suddenly expands into a large subapical blackish patch extending below vein 1, otherwise markless. Secondaries markless.

Underside: both wings pale clear lemon-yellow. Primaries with a fine curved row of internervular dashes in the submarginal area from veins 10 to 3; termen finely black. Secondaries with a deeper lemon-coloured submarginal stripe from the costa to the abdominal margin.

Expanse 35 mm.

*Hab.* Bitje, Cameroons.

Type in the British Museum (Adams Coll.).

This is like a very enlarged *decipiens*, but the colour is quite different; the apical area, as also the pattern below, likewise differs.

*Liptena decipiens cameroona*, subsp. n.

♂ ♀. Upperside: both wings cream-colour; with costa of

primaries narrowly brown, and the apical area extending from the middle of the costa right down to vein 2 very broadly blackish brown. Secondaries uniform cream, quite markless.

Underside: primaries yellowish, more pronounced in the apical area; termen finely blackish to below vein 3, internally from this is another blackish line to vein 4, which varies considerably, sometimes being absent, sometimes with merely very fine interneural dashes, and at others a defined dark line. Secondaries very pale lemon-yellow, with a trace of subterminal interneural very fine brown dashes.

Expanse 32 mm.

*Hab.* Bitje, Cameroons (*Bates*).

Type in my collection. A series; also a small series in the British Museum (Adams Collection). The ordinary form of *decipiens*, Kirby, is white with a smaller dark apical area, and is a decidedly smaller and less robust species.

*Liptena batesana*, sp. n.

♂. Both wings pure white. Primaries with costa narrowly darkish grey; a smallish grey apex extending along the termen to vein 4 only.

Underside: both wings white; primaries with termen narrowly ash-brown, this being preceded by a submarginal pale ash-brown line to vein 3. Secondaries with a fine pale ash-brown terminal border preceded by a very pale grey-brown submarginal line from the apex to the anal angle.

Expanse 28 mm.

*Hab.* Bitje, Cameroons (*Bates*).

Type in my collection.

Easily recognised from *decipiens* by its smaller size, reduced apical patch, and by the submarginal line in the secondaries.

*Liptena bassæ*, nom. nov.

In the Ann. & Mag. Nat. Hist. ser. 7, vol. xviii. p. 340 (1906), I described a new *Liptena* under the name *L. subpunctata*. I afterwards found that the latter name was preoccupied in the genus, and I therefore re-name it now under the title *L. bassæ*, the Nigerian Province where it obtains.

*Liptena occidentalis*, sp. n.

♀. Upperside: both wings tawny orange with the termen blackish brown for a quarter of the wing. Primaries with the costa blackish brown extending right over the cell and to well beyond it, subapical area extended basewards so as to leave only a narrow band of the ground-colour between it and the dark costal area.

Underside: primaries pale orange with the upperside black areas showing through, in the costal area there are three dark marks

across the cell and a larger dash beyond it. Secondaries warm pinkish buff, with ash-grey indefinite spots, three basal ones, rather indistinct, three across the cell, a series of seven more or less confluent spots forming a postmedian curved stripe, another more obscure stripe marking the termination of the upperside black border, a series of seven interneural subterminal grey dashes.

Expanse 86 mm.

*Hab.* Bitje, 2000 ft., Cameroons (*Bates*).

Type in my collection.

*Liptena eukrinaria*, sp. n.

♂. Upperside: both wings bright palish orange. Primaries with a large irregular apical patch extending in a fine line down the termen for its lower half. Secondaries with the termen very finely dark, doubled between veins 2 and 4.

Underside: primaries clear yellowish, two small dark spots on the costa above the cell, four very oblique and slightly curved dark spots in the apical area, beyond which is a trace of a short crenulate line from the costa to vein 5 followed by a fine dark subterminal line to about vein 8. Secondaries buff-colour, with darkish grey spots, three small ones across the base of the cell followed by one in the cell with a second below it, a large one closing the cell, beyond this from vein 6 are four or five quite small spots in a slight curve, postmedian row consisting of seven larger spots following the shape of the wing and succeeded by the narrow subterminal line; termen finely dark.

Expanse 86 mm.

*Hab.* Cameroons, S. Nigeria (*Cator*).

Type in Cator's collection.

This seems nearest to *L. turbata* or *eukrines*, but is very different above and below.

*Liptena eketi*, sp. n.

♂. Upperside: both wings, pale dull orange-colour. Primaries with the costa broadly brownish making a wedge-shaped termination beyond the cell, this is followed by another wedge-shaped costal patch ending in front of the apex about vein 4; termen narrowly brown for the costal third. Secondaries dusky below vein 6, with underside pattern showing more or less through.

Underside: primaries like the upperside, but with the dark areas narrower. Secondaries cream-colour, crossed obliquely by seven brownish-grey broad bands, the second and third confluent below the costa, and the seventh taking the shape of the wing-termen, termen very finely cream-colour preceded finely by a dark line.

Expanse 28 mm.

*Hab.* Eket, February 27th, 1920 (Southern Nigeria).

Type in Cator's collection.

This is not very near any species I know.

*Eresina bitjensis*, sp. n.

♂. Upperside: both wings pale ochreous. Primaries slightly irrorated with greyish on the costa and with four costal grey spots, apex greyish, this area somewhat reduced. Secondaries with no marks except a fine dark point at the end of each vein.

Underside: primaries paler ochreous, with the costal area as above and apical area irrorated instead of being solid grey; termen with a submarginal crenulate line from the costa to vein 1, followed by a fine grey line. Secondaries buff-colour, very finely irrorated with grey, two sub-basal grey spots are above one below the cell, followed by three grey spots across the wing, postmedian line consisting of five internervular spots, a gap being between the first near the costa and the second, the second to the fifth are strongly oblique, two crenulate submarginal lines, the dark points at the end of the veins slightly emphasised.

Expanse 34 mm.

*Hab.* Bitje, Cameroons.

Type in my collection, ♂ ♂ (*Bates*).

The colour of the wings immediately separates it from *E. corynetes*.

*EPITOLINÆ.**Epitola entebbeana*, sp. n.

♂. Upperside: primaries black with the fold below the cell and vein 2 deep blue not extending to the termen, a patch of deep blue in the cell, a postmedian transverse subcostal oblique bar of confluent spots as in *conjuncta*, Kirby. Secondaries black above vein 6, entirely deep blue below it and right up almost to the termen.

Underside: primaries, costal half brown, a black area below pale on inner margin, an ill-defined white interneural small patch between veins 2 and 3, and below it a larger interneural whitish patch extended basewards. Secondaries brown with traces of pale transverse indefinite lines across the end of the cell in the postmedian and two in the subterminal area.

♀. Upperside: primaries dark brown, with a paler blue area as in the male, but less extensive; a postmedian subcostal bar of four distinct oval white spots. Secondaries dark brown with a paler blue area restricted to the centre of the wing.

Underside: both wings uniform pale kidney-brown, primaries with white spots showing through, secondaries with the transverse indistinct lines as in the male.

Expanse, ♂ 43, ♀ 40 mm.

*Hab.* Entebbe, Uganda Protectorate; Oban, S. Nigeria.

Types, ♂ in the British Museum, ♀ in Cator's collection. 2 ♂ ♂ and 1 ♀.

It is possible that this may be the Uganda form of *conjuncta*, Smith & Kirby, but the shape of the wings is different, as also the

blue areas in both wings so far as the males are concerned. The female from Southern Nigeria seems exactly to fit these males and it does not agree with that sex of *conjuncta*.

*Epitola radiata*, sp. n.

♂. Upperside: both wings black with very dark blue dashes in the cell, in the interneural area below the cell, and between veins 2 and 3, and also traces of blue scales in the other interneural areas in the primaries; in the secondaries with the blue in the cell and continued beyond in the median and submedian areas only.

Underside: dull pale brown, quite uniform, except that most of the cell and below it, and below vein 5, is deep black.

♀. Upperside: both wings dull brown. The primaries with an indefinite subcostal oblique row of three obscure pale spots beyond the cell.

Underside as in the male.

Expanse, ♂ 39, ♀ 35 mm.

*Hab.* Bitje, Cameroons (*Bates*).

Types in the British Museum. 2 ♂♂ and 1 ♀.

This is one of a very difficult and obscure section of the genus, and is allied to *E. mus*, Suffert, and *sublustris*, B-B.

LYCENINÆ.

*Pseudaletia catori*, sp. n.

♂. Upperside: both wings dirty whitish yellow, with black termen. Primaries with the radial area whitish, apical area and termen very broadly black, somewhat as in *agrippina*, Druce, and with a similar, but smaller, row of terminal white spots, a small obscure black dash near the base on the upper edge of the cell, followed by a black spot, cell closed by a broad black dash. Secondaries with the termen as in Druce's species, but the black border is decidedly narrower and the white spots smaller.

Underside: primaries yellowish white, whiter in the radial area, with a black basal dash in the cell, followed by three oblique broad black costal bars, two across the cell and a small one beyond it, apical area blackish with two whitish spots in it followed by three large terminal ones; at the tornus a white terminal spot with a small blackish internal edging. Secondaries whitish yellow, with two rows of three whitish spots divided by a black line in the apical area, and two rows of two white spots in the anal area in a black patch. Abdomen black, with whitish segmental divisions.

Expanse 60 mm.

*Hab.* Olle, Kabba Province, N. Nigeria (*Cator*).

Type in Cator's collection.

*Pseudaletia occidentalis*, sp. n.

♂. Upperside: both wings black with white patches. Primaries with a small white spot in the cell just before its end, a broad



tapering transverse white patch, narrow near the costa to about vein 2 near the termen. Secondaries with a large white oblique central area from the base and costa almost to vein 1, terminating before it reaches the termen; two white points at the anal angle, between which the long black tail is ejected.

Underside: both wings brown with the white areas as above. Secondaries with the fold and inner margin irrorated with yellow scales, anal angle with two black spots edged externally with metallic scales, edged internally with yellowish, which is edged internally by a black dash with a central line of metallic scales; a similar larger black dash with metallic scales is further up the inner margin.

Expanse 48 mm.

*Hab.* Bitje, Cameroons (*Bates*).

Type in my collection.

*Hypolycæna bitjeana*, sp. n.

♂. Upperside: both wings bluish grey. Primaries with bluish area extending to end of cell, underneath the smallish cell-patch, and descending abruptly to vein 2, along which it runs towards the tornus, the rest of the wing black. Secondaries with bluish area from vein 1 beyond vein 5, above vein 6 the costa is black to the apex, bluish area interrupted by the broad jagged postmedian stripe, and again by a broken submarginal stripe; a black marginal spot between veins 2 and 3, and another on the anal lobe.

Underside: both wings whitish with bronze orange-yellow broad stripes. Primaries with the postmedian stripe oblique and rather arched; the subterminal dark line from the costa to vein 1, angled outwards below the apex, from whence to the termen it is suffused with dark greyish. Secondaries with the orange stripe very broad, broken at vein 2, and then shifted basewards and angled nearly up to the inner margin, subterminal dark line extended right round the anal angle to vein 1, a large subterminal black spot with orange internal edging, lobe fairly prominent with crimson internal edging.

Expanse 38 mm.

*Hab.* Bitje, Cameroons (*G. L. Bates*).

Type in my collection.

This should come next to *H. liara*, Hew., but the sex-spot is much smaller, about half the size—it is bluer. On the underside the lines and stripes are broader and in a different position, whilst the anal spot is edged internally with crimson, not orange or red.

*Iolans celestis*, sp. n.

♂. Upperside: both wings bright sky-blue, extending over the sex-mark in the hind wings. Primaries with the blue area large, extending well over the cell and going to the tornus in more or less a straight transverse line; apex and termen widely black and extending well basewards on the costa. Secondaries with the apex

broadly black, extending rapidly and finely to the upper tail, edge of anal lobe broadly white with a largish black marginal spot above it and a small black and crimson one on the abdominal side; three tails.

Underside white. Primaries with the apex broadly pale brownish edged internally with a grey spotted line (confluent) to about vein 8. Secondaries with the least trace of a fine postmedian line, the submarginal line more distinct, a fair-sized black spot near the third (upper) tail edged very broadly with carmine, a fine carmine-red line to the anal carmine area, a small blackish spot on inner margin. A large black pencil of sexual hairs to the primaries. Frons white. Legs barred with black.

Expanse 40 mm.

*Hab.* Bitje, Cameroons, 2000 ft. (*G. L. Bates*).

Type in my collection.

Apparently allied to *I. sibella* and *barbara*, but area of blue above and the pattern below different.

*Iolau bansana*, sp. n.

♀. Upperside: both wings white with restricted blue scaling at the base. Primaries with the blue scaling extended along the inner margin. Apex very broadly black nearly to the cell and extending very broadly to about vein 2, where it narrows and is broadly black to the tornus. Secondaries with a dark cloud at the apex and a submarginal dark stripe from the apex to the anal area; anal lobe with a small black and orange spot; termen itself black, linear.

Underside, both wings pure white. Primaries with a narrow chestnut-coloured line which closes the cell and is followed by a broadish chestnut-coloured transverse stripe to about vein 2; a curved series of browner interneural submarginal fine dashes; termen broadly brownish grey to near vein 2. Secondaries with the same markings as the primaries, the stripe beyond the cell is more oblique and is narrowly carried right round the anal angle on to the abdominal fold, the submarginal series is a continuous line of bright chestnut with a black submarginal spot between veins 2 and 8 surrounded with pinkish irroration, and another spot at the anal angle with metallic-bluish scales and an internal suffusion of beautiful pinkish-lilac scales; three anal tails, the uppermost very short.

Expanse 38 mm.

*Hab.* Bansa Mountains, 6000 ft., Cameroons, September (*G. L. Bates*).

Type in my collection.

This species is near *Iolau bolissus*, Hew., but is much smaller and the pattern easily recognisable.

*Iolau parva*, sp. n.

♂. Upperside: both wings brightish blue with black apices and

margins. Primary with very broad apex and termen and less broad costa, the blue area reaching beyond the cell. Secondaries with the black apex much reduced and the termen linear, a small black anal lobe-spot edged above with reddish, a larger terminal spot between veins 1 and 2 and a smaller one between 2 and 3, a fine white subterminal line to the third spot.

Underside: both wings white with dark transverse lines. Primaries with an oblique waved dark line bent outwards at vein 4, a subterminal line beyond, apical area slightly brownish, a linear dash closes the cell, a small black brush and small shiny patch on inner margin. Secondaries with a dark oblique postmedian line extending round into the abdominal lobe, but broken inwards at vein 2, an indistinct subterminal line, a black lobe-spot with metallic-blue scales, a large black terminal spot between veins 2 and 3, both of these spots well surrounded with bright orange which is confluent between these spots; three tails.

♀ like the male, but the blue area is paler and more restricted.

Expanse 34 mm.

*Hab.* Bitje, Cameroons, 2000 ft. (*G. L. Bates*); also in Cator's collection from Southern Nigeria.

Type in my collection.

I cannot place this small *Iolais* near any species, its small size and very defined underside markings ought to make it readily recognisable.

*Epamera yokoana*, sp. n.

♂. Frons orange-colour. Both wings above pale blue, almost silvery, with black apical areas. Primaries with blue area reaching nearly to the costa, not reaching the end of the cell, sharply defined in an oblique direction to a quarter from the tornus; sex-lobe not prominent, but quite apparent on the inner margin. Secondaries above with the blue area from vein 1 *a* to above vein 3 and extending slightly into the cell, a very large silvery shining sex-patch nearly to the apex which is black, a slight dark anal lobe-spot with a long tail and a shorter one above it.

Underside: both wings white. Primaries with the apex and termen broadly brownish gray to vein 2, and bordered internally by a pale chestnut-brown stripe, not a line, the whole of the inner marginal area below the cell is more or less strongly shining, but there is no pencil of hairs, though there is a small sex-patch on the lobe. Secondaries with a similar postmedian stripe as in the primaries, angled in anal area as usual and extending in a line into the fold, an oblique waved subterminal line from the apex to the upper black spot, which is edged internally with orange and has bright blue-metallic scales, which edging and scales extend to the lobe-spot, which has an external bright pale blue patch of metallic scales, the orange-colour is extended in a short stripe into the fold.

Expanse 40 mm.

*Hab.* Yoko, Cameroons, 2000 ft., July (*G. L. Bates*).

Type in my collection.

This species is next to *E. mirabilis*, H. H. D., but the sex-patch in the secondaries is much larger than in Druce's insect, and the stripes on the underside are different both in position and form.

*Epamera kumboæ*, sp. n.

♂. Upperside: both wings pale sky-blue. Primaries with the blue not reaching the upper angle of the cell, but just touching the lower angle and extending nearly to the tornus, more than the apical half of the wing is black down to the tornus, inner margin with the sexual lobe very prominent near the base. Secondaries with the blue area not extending into the abdominal fold and just up to vein 5. Sex-patch very large, occupying the whole of the cell to the costa and reaching nearly to the apex; apex very restricted pale brownish grey.

Underside: both wings entirely white. Primaries with the cell closed by a fine pale brownish dash, postmedian line waved, fine, reaching to vein 2, no other mark on the wing. Sex-patch very large, very shining to the tornus and with a pencil of black hairs. Secondaries with the cell closed by a very fine brownish dash, postmedian brownish line oblique to vein 2, where it is distinctly broken, the angled part extending to the inner margin starts from a little inwards of the oblique line, upper black spot well away from the termen, edged internally with a restricted orange patch, black lobe-spot with a little external metallic-blue scaling and a larger internal orange edging, which has scattered pale blue-metallic irrorations. Three tails.

Expanse 38 mm.

*Hab.* Kumbo, Nigeria, 5500 ft., October (*G. L. Bates*).

Type in my collection.

This species appears to stand near *E. athria*, Karsch, but the shape and direction of the lines are very different.

*Aphnæus neavei*, sp. n.

♂ ♀. Upperside: both wings dull grey, with the termen finely black. Primaries with a white subhyaline spot closing the cell, two subcostal similar spots beyond it, and a row of three like spots further out, and slightly oblique below vein 5. No markings in the secondaries.

Underside: both wings greyish buff with pearly spots. Primaries with two spots in the cell and one at its end, three costal spots beyond it touching and below each other, an isolated subapical spot and three larger oblique spots below vein 5. Secondaries with a large costal spot near the base with a little one below it, a largish subapical costal spot with another below it shifted inwards, and below that shifted outwards a smaller one, a trace of a small dash in the middle of vein 2; two dashes on the inner margin above the anal angle, a straight, erect, indefinite dark

cloudy stripe in the postmedian area from near the apex to the anal angle.

Expanse, ♂ 36, ♀ 40 mm.

*Hab.* Magogoni swamp, near Witu (*Neave*).

Types in the British Museum. 1 ♂ and 2 ♀ ♀.

This species is quite distinct from any others, but is near to *A. waggæ*, E. M. Sharpe.

*Spindasis banyoana*, sp. n.

♀. Upperside: both wings dull grey with the underside pattern showing through; secondaries with a small black anal spot and a smaller one beyond it, separated by orange colour which broadly edges both spots internally. Two long tails.

Underside: both wings very pale lemon-colour approaching whitish, with the usual *Spindasis* markings having traces of internal silvery stripes. Primaries with a basal spot immediately followed by a broad double stripe from the costa to the lower cell-margin, beyond this is an oblique one across the end of the cell and spread out half along vein 2; on the costa a small triangle followed by a broadish bar from the costa nearly down to vein 3, a double submarginal line; termen rather finely dark and very defined. Secondaries with a basal double stripe, and below it another on the fold, and a trace of a third below it just on the inner margin, a tapering median one across the end of the cell ending halfway down vein 2, a postmedian one from the costa to vein 4, a submarginal slightly curved one; termen rather narrowly dark and sharply defined; a small twin anal spot separated by orange-colour, which extends broadly and tapering up to vein 5, its external margin obliterating that portion of the internal edge of the submarginal double stripe; in this orange band are central interneural silvery dashes.

Expanse 27 mm.

*Hab.* Banyo, 8000 ft., Cameroons, August (*G. L. Bates*).

Type in my collection.

It is, perhaps, nearest *S. avriko*, Karsch; but its upperside (unicolorous grey) and the orange stripe from the anal angle on the underside should separate the species easily from all others.

*Spindasis chalybeata*, E. M. Sharpe.

The female of this species is, I believe, unknown; but I possess a specimen of this sex, and it will be well to describe it.

♀. Upperside: both wings dark brown without any markings. The primaries have the fold and median area to the base warm russet-colour. The underside is like the male, but the colour is less dark, clearer, and brighter.

*Hab.* Bitje, Cameroons, 2000 ft. (*Bates*).

Type in my collection.

*Cupidesthes paralithas*, sp. n.

♂. Upperside: both wings blue with blackish areas. Primaries with the blue area confined to the cell and below vein 2; it thus has an angulated external edge, rest of the wing black. Secondaries blue with the area above vein 6 blackish.

Underside: both wings white with pale brownish lines much broken up. Primaries with irregular twin lines across the end of the cell, a postmedian similar fascia, most crenulate as to its exterior edge and most irregular on its internal edge, having a sharp inward projection along vein 8 and in the space between 2 and 3, a trace of a submarginal line. Secondaries with a subbasal spot below vein 8 and one below it on the inner margin, cell closed by a twin dash; postmedian fascia irregular, consisting of eight spots, two below each other on the costa, one shifted well outwards, two confluent further out, one inwards, one isolated right inwards with one on the abdominal fold, a subterminal ill-defined line, an anal spot with orange and a black one beyond it.

♀. Upperside: both wings white, primaries with broad costal brown border, a very broad apical area, and a broad termen. Secondaries with a broadish brown subterminal line, and beyond it a marginal row of black marks.

Underside: exactly like the male, except that the stripes are broader.

Expanse, ♂ 32, ♀ 40 mm.

*Hab.* Uwet, Adiarbo (S. Nigeria), Bamenda (Cameroons).

Types in Cator's collection. 3 ♂♂, 1 ♀.

Allied to *C. lithas*, Hew., but it may be recognised by the ground-colour of the underside being quite white all over with the pattern just darkly outlined.

*Lycænesthes bakeri*, Druce.

When I wrote my "Revision" of this group and was examining the specimens in Hamilton Druce's collection, I understood that he was about to describe this species under the name of *ja*, and I listed it as such in my "Revision" (Trans. Ent. Soc. Lond. 1910, p. 58); but he subsequently dedicated it to me, and it is therefore advisable to make this correction.

*Triclema inferna*, sp. n.

♀. Upperside: both wings uniformly blackish with the underside pattern showing more darkly through. In a really fresh specimen probably the colour would be entirely black, not showing the pattern through.

Underside: both wings brownish ash-grey with darker markings encircled broadly with white. Primaries with a subbasal wedge-shaped mark, followed by a fine line, crossing the cell; a large spot closes the cell, and below it, below vein 2, is another large spot;

between veins 4 and 5 is a smaller spot, and from vein 4 to the inner margin is a broad stripe; two transverse curved dashes from the costa to below vein 3 outside the broad stripe just referred to, a pair of broadish subterminal lines. Secondaries with a broad subbasal stripe right across the wing, followed by another broad oblique stripe right across the wing and crossing the end of the cell; between this and the subbasal stripe is a short dash across the fold; beyond the cell is another interrupted stripe, beginning in a spot on the costa, reaching into the abdominal fold, beyond which is another to about vein 2, which is doubled between veins 6 and 8; subterminal line distinct with a spot in the subanal area. Termen finely dark, sharply defined.

Expanse 19 mm.

*Hab.* Bitje, 2000 ft., Cameroons (*G. L. Bates*).

Type in my collection.

Not very near any species, but is probably nearest *T. fasciata*.

*Triclema africana*, sp. n.

♂. Upperside: both wings uniform brown. Secondaries with a subterminal row of pale spots, and a terminal row of spots and a black spot between veins 2 and 3.

Underside: both wings very pale grey, with darker spots encircled with white. Primaries with a wedge-shaped basal spot, followed by two dashes below each other, followed by two spots in veins 2 and 3, beyond these are several; two spots further out between veins 5 and 6 and 6 and 7. A subterminal row of distinct spots, beyond which is a dark subterminal one; termen finely dark. Secondaries more or less whitish, with a subbasal band across the wing, followed by an interrupted stripe crossing the end of the cell; a trace of a very interrupted stripe beyond this, a subterminal narrow stripe, a very small anal dark spot, a black spot on each side of vein 3 with some red about them.

♀. Similar above, but below white, with the spots as in the male, but more exaggerated and contrasting strongly.

Expanse, ♂ 24, ♀ 48 mm.

*Hab.* Northern Nigeria and Bitje, Cameroons.

Type in my collection.

This species is near *T. fasciata*.

I am inclined to think that the type is a Gynandromorph from the shape of the wings; the legs are, unfortunately, absent.

*Triclema quadricaudata*, sp. n.

♀. Upperside: both wings uniformly dark brown with no trace of any pattern. Secondaries with four fine short tails at the end of veins 1, 2, 3, and 4, which are creamy white like the fringes. There is a very fine subterminal whitish line.

Underside: both wings brown, with darker markings palely and finely edged; termen broadly pale, indefinite as to its inner

margin. Primaries with a basal spot, another closing the cell, a postmedian series highly curved, almost angled between veins 4 and 5, of seven oval confluent spots from the costa to the inner margin, that on the costa small, the others largish; a series of subterminal lunules, followed by a fine dark line. Secondaries with three subbasal transverse spots, the central one small with a fourth inner marginal spot touching the third, a large rectangular spot closing the cell; a postmedian series of eight largish spots as in the primaries, but the seventh and eighth spots in this series are the third and fourth spots referred to earlier, the postmedian row receding so very far in this area; a subterminal row of rather indefinite lunular marks with an anal and subanal spot of blue-metallic scales over black spots; there is also a trace of reddish edgings to both spots.

Expanse 20 mm.

*Hab.* Bitje, 2000 ft., Cameroons (*G. L. Bates*).

Type in my collection.

This species is very distinct—it is, perhaps, nearest to *T. gemmifera*, Neave; but the pattern is different, especially the postmedian band, and it lacks the four bright submarginal spots.

*Azanus tongidensis*, sp. n.

♂. Upperside: both wings pale brownish with pale violet areas. Primaries with the cell and three-quarters of the fold below it pale violet, all the nervules darkly outlined. Secondaries with the area below vein 6 from the base pale violet, extending up to the submarginal area, where it terminates abruptly; a dark triangular spot between veins 2 and 3, and a smaller, less distinct one at the anal angle.

Underside: both wings dull grey with slightly darker spots outlined with whitish. Primaries with a largish spot closing the cell, followed closely by the postmedian band of interneural spots, the first four slightly curved, the second being shifted slightly outwards, the fifth somewhat oblique and shifted inwards, the sixth oblique also right across the fold and shifted right inwards, a trace of a marginal row of spots, more prominent at the tornus. Secondaries with three dark subbasal spots below each other, a spot closing the cell, postmedian band in a fairly even curve all across the wing, the second spot shifted outwards from the first, the third and fourth outwards again, the fifth slightly inwards, the sixth more inwards, and the seventh large angled spot still more inwards, a trace of a marginal row, with the two dark spots above repeated and with a slight trace of orange.

Expanse 22–28 mm.

*Hab.* Tongido, S.E. Africa.

Type in my collection. 2 ♂♂.

This species is not near any of the genus. I was at first doubtful where to place it; but it is, I believe, an aberrant species of this genus.



*Cyclyrius wollastoni*, sp. n.

♂. Upperside: both wings dull violet-blue, rather leaden in hue, with broadish brown hind margins. Primaries with the blue rounded off in the apical area, and with tessellated fringes. Secondaries with a round black spot on the subterminal area between veins 2 and 3.

Underside: both wings cinnamon-brown with whitish-grey irroration. Primaries with a ground-colour spot at the end of the cell, with a postmedian curved band of five reniform spots and a trace of a sixth below it; beyond this the subterminal area more or less with whitish-grey irrorations with a terminal row of interneural spots. Secondaries irrorated with whitish grey, with pattern standing out in ground-colour. A subbasal very irregular and broken band of four spots, the second obsolescent, a median irregular band of eight confluent spots, the sixth shifted inwards to touch almost the third spot of the subbasal band, a lunular row of submarginal marks followed by a marginal row of spots inclined to evanescence in the apical area, a dark spot on the termen between veins 2 and 3 with metallic-blue scaling.

Expanse 28 mm.

*Hab.* Ruwenzori Mt., 10,000 ft., Uganda Protectorate (*Wollaston*).

Types in the British Museum.

This species is near *noquassa*, but the pattern and blue areas are decidedly different; it may replace that species in this mountainous area.

*Cyclyrius boma*, sp. n.

♂. Upperside: both wings very dark rich brown with the basal three-quarters of the wings dull deep violet, in a dull light looking brownish; the secondaries have a deep black marginal spot between veins 2 and 3.

Underside: primaries cinnamon-brown with a large spot in the cell and an equally large one closing it, a *very* broad postmedian band slightly tapering towards the inner margin right across the wing; termen whitish, preceded by anteneural dark dashes. Secondaries darker cinnamon-brown with a more or less confluent, almost basal row of indistinct spots across the base sharply outlined with white, a similar band more distinct across the end of the cell, followed by a small whitish subcostal area, and followed by a broad oblique postmedian band edged with white and with its outer edge fairly regular—that is, with no marked outward projections. This is followed by a broad white band, beyond which the wing is brown with a trace of a marginal row of spots and the black spot between veins 2 and 3, with a little metallic scaling. Fringes of both wings tessellated white and brown.

Expanse 24 mm.

*Hab.* Boma Musinga, S.E. Africa.

Type in my collection. 4 ♂♂.

This species is allied to *C. juno*, Btl.; but the blue area is decidedly larger and the shape of the band and the spots below are quite different.

LV.—*New Species of Phytophaga (Col.)*. By G. E. BRYANT, Entomological Assistant, Imperial Bureau of Entomology.

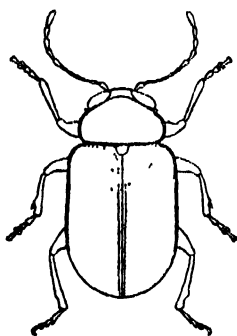
Family *Eumolpidæ*.

*Metachroma wolcotti*, sp. n. (Fig. 1.)

Oblong, convex, black with slight metallic-green tinge, the labrum, antennæ, legs, epipleuræ, apex of elytra, and abdomen fuscous. L. 4.50 mm.

Head metallic black, rugosely punctured between the eyes, less so towards the base, the antennæ and mouth-parts fuscous; the antennæ extending to about the middle of the

Fig. 1.



*Metachroma wolcotti*, sp. n.

elytra, the first joint more swollen than the second, all the joints about equal in length with the exception of the third, which is shorter than the second or fourth. Prothorax black with metallic tinge, almost smooth, with feeble scattered punctures, the sides rounded and margined, with the anterior angles strongly toothed. Scutellum fuscous and impunctate. Elytra black, less metallic, slightly broader at the base than the prothorax, punctate-striate, with the punctures becoming feebler from the base to the apex, with the apex almost smooth and slightly fuscous, the sutural stria well marked. Legs fuscous, with scattered pubescence, the femora with a slight metallic tinge, the tibiæ fuscous, with the middle and hind pair strongly notched at the apex, the tarsi fuscous but

slightly paler than the tibiæ, claws bifid. Underside with the coxæ and abdomen fuscous, the first segment the longest, the other segments about equal to each other, with short scattered pubescence.

HAITI: Port au Prince, v. 1925, at light (*G. N. Wolcott*).

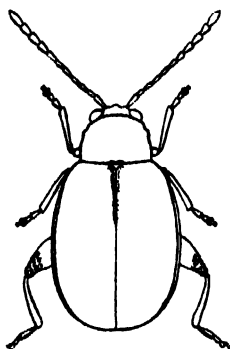
Allied to *M. adusta*, Suffr., from Cuba, but may be distinguished by its larger size, metallic tinge, and the striæ not nearly so strongly or closely punctured; also the apex of the elytra is not so well marked with fuscous.

### Family Halticidæ.

#### *Aphthona hargreavesi*, sp. n. (Fig. 2.)

Entirely pale flavous, with the exception of the apical joint of the antennæ, the labrum, and the apex of the hind femora,

Fig. 2.



*Aphthona hargreavesi*, sp. n.

which are black; the prothorax impunctate; the elytra with very fine punctures. L. 2 mm.

Head impunctate, the labrum black, the frontal elevations distinct, bounded above by oblique grooves; the antennæ extending not quite to the middle of the elytra, the four basal joints and the basal half of the fifth flavous, the apical joints black, the first and second a little more swollen than the third, and the first about as long as the second and third combined, the four terminal joints more elongate and thickened than the preceding. Prothorax a little broader than long, slightly narrowed in front, with the sides slightly

rounded, and angled in front, impunctate. Elytra a little wider at the base than the prothorax, subparallel, with the apex rounded, the surface with very fine scarcely visible punctures. Legs with the posterior femora strongly incrassate, with the apical portion tinged with black, the tibiae slightly dilated at the apex, the first joint of the posterior tarsi as long as the following joints together. Underside with slight pubescence, with the ventral segments about equal to each other.

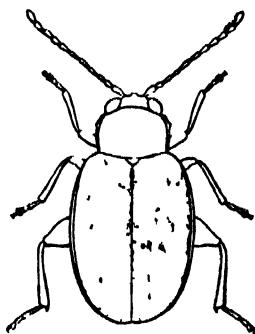
SIERRA LEONE: Blama, 11. i. 1925 (*E. Hargreaves*); eight specimens.

Allied to *A. marshalli*, Jac., and *A. minuta*, Jac.; differs from the latter in its larger size and black apex to the hind femora; in *A. marshalli* the hind femora are entirely black and the puncturation of the elytra stronger.

*Aphthona sierræleonis*, sp. n. (Fig. 3.)

Subquadrate-ovate, the head, prothorax, basal joints of the antennæ, and legs reddish fulvous, the hind femora tinged

Fig. 3.



*Aphthona sierræleonis*, sp. n.

with piceous, the elytra metallic greenish blue finely and closely punctured, underside with the meso- and metasternum and ventral segments piceous. L. 2 mm.

Head reddish fulvous, impunctate, clypeus strongly raised between the antennæ, the labrum piceous; the antennæ slender, reaching to about the middle of the elytra, the four basal joints fulvous, the fifth and remaining terminal joints

black, the first joint longer than the second, and the second a little shorter than the third and more ovate, the remainder about equal to each other. Prothorax subquadrate, reddish fulvous, broader than long, the sides very slightly rounded, with the anterior angles oblique, the surface impunctate. Scutellum blue-black. Elytra metallic greenish blue, wider at the base than the prothorax, convex, with the shoulders moderately prominent, the surface finely and closely punctured. Legs reddish fulvous with fine greyish pubescence, the hind femora tinged with piceous. Underside with the meso- and metasternum and ventral segments piceous, clothed with scattered pubescence.

SIERRA LEONE: Blama, 11. i. 1925; eight specimens (*E. Hargreaves*).

Allied to *A. bohemani*, Jac., from which it is distinguished by its much smaller size, its colour more green, the elytra more strongly punctured and less convex, and the hind femora only tinged with piceous.

*Chaetocnema metallica*, sp. n. (Fig. 4.)

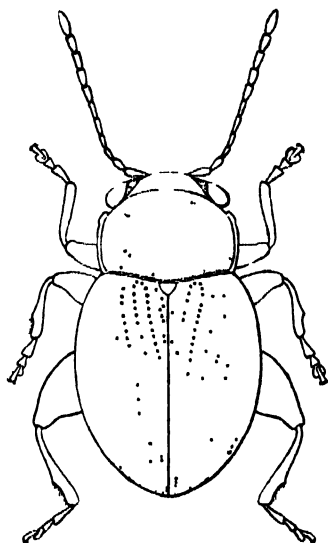
Metallic bronze, the antennæ flavous with the apical joints fuscous, the legs flavous with the hind femora fuscous; head impunctate except near eyes, but very finely shagreened, eyes very prominent; prothorax finely and irregularly punctured; elytra deeply punctate-striate. L. 2 mm.

Head metallic bronze, finely shagreened, with a few large punctures near the inner margin of the eyes, which are very prominent; antennæ with the six basal joints flavous, the two basal joints more swollen than the following, the five apical joints fuscous and broader, extending a little beyond the shoulder. Prothorax transverse, metallic, with fine and scattered punctures, the sides margined and the anterior angles well rounded. Scutellum impunctate, subtriangular. Elytra convex, subcylindrical, rounded at apex, strongly punctate-striate; the fifth, sixth, and seventh striæ meeting before reaching the apex and continued as one; the interstices at the sides longitudinally convex. Legs flavous, with the hind femora fuscous, the middle and posterior tibiae toothed below the middle on the outer margin. Underside with the metasternum rugosely punctured, the ventral segments distinctly but sparingly punctured; the first segment the longest, equal to the three following, the third and fourth equal to each other and together equal to the

second, the fifth longer than the third and fourth together and more strongly punctured.

SIERRA LEONE: Pokuma, 3. ii. 1925; one specimen (*E. Hargreaves*).

Fig. 4.



*Chatocnema metallica*, sp. n.

A very distinct species, and may be distinguished from the known African species by its more prominent eyes, the nearest ally being *C. semiregulata*, Jac.

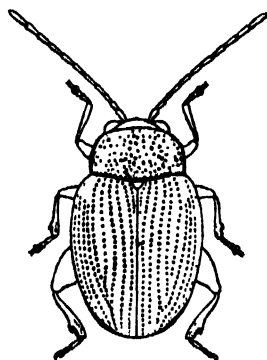
*Chatocnema zeæ*, sp. n. (Fig. 5.)

Ovately subquadrate, black, shining; head impunctate; prothorax very finely punctured; elytra strongly punctate-striate, with the interstices smooth and shining; antennæ and legs fulvous, with the hind femora black. L. 1.25-1.50 mm.

Head black, impunctate, with a small depression above each eye; the palpi fulvous; the antennæ fulvous, with the five apical joints slightly fuscous and more elongate, extending to about the middle of the elytra. Prothorax black

and shining, very finely punctured, convex and transverse, with a row of larger punctures along the basal margin; the sides slightly rounded. Scutellum black and impunctate, slightly transverse. Elytra of subquadrate form, black and shining, strongly and regularly punctate-striate; the interstices impunctate, but very slightly costate at the sides. Legs fulvous, with the hind femora black, the front and intermediate femora slightly fuscous in the middle, the middle of hind tibiæ with a tooth below the middle. Underside black, with the sternum impunctate and shining; the ventral segments feebly punctured with short scattered pubescence.

Fig. 5.

*Chalocnema zea*, sp. n.

♂. Differs in its smaller size and in having the first joint of the front tarsi more swollen.

SIERRA LEONE: Rotifunk, 10. x. 1924; twelve specimens, on maize (*E. Hargreaves*). Makrambe, 26. ix. 1924; three specimens, on grass (*E. Hargreaves*).

Allied to *C. subquadrata*, Jac., and *C. compressipes*, Baly, in structure. Easily distinguished from the latter by its much smaller size and its colour, and from *C. subquadrata*, Jac., from Mashonaland, by the colour of the legs and its more shining and polished appearance.

*Argopistes hargreavesi*, sp. n. (Figs. 6, 6b.)

Ovate, convex, castaneous; head black and finely punctured; prothorax black, with the basal part castaneous in

the middle, finely punctured; elytra castaneous, with the apical third black and the outer margins narrowly black, very finely and irregularly punctured; underside castaneous, with the apical segment black. L. 2 mm.

Head nearly hidden in the prothorax, black, with the front and clypeus castaneous, finely punctured, with a narrow longitudinal impression extending from between the insertion of the antennæ towards the base; antennæ flavous, extending to beyond the base of the elytra, the first joint twice as long as the second, the second more swollen and a little longer than the third, the five apical joints stouter. Prothorax transverse, widest at the base, with the sides rounded and contracted in front, black with the basal part castaneous in

Fig. 6.

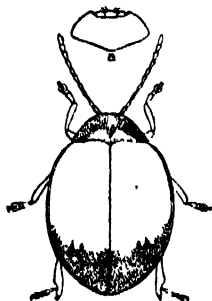
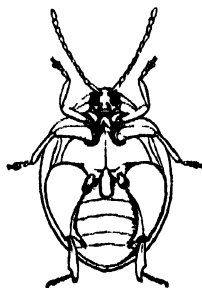


Fig. 6 b.



*Argopistes hargreavesi*, sp. n.

Fig. 6.—Upper surface. a, head and prothorax viewed from in front.

Fig. 6 b.—Lower surface.

the centre, finely punctured. Scutellum castaneous, triangular and impunctate. Elytra broader at the base than the prothorax, castaneous, with the apical third black, extending obliquely to the middle of the outer margin, thence very narrowly black to base, very finely and irregularly punctured. Legs castaneous, with the hind femora very much enlarged, black, armed at the apex with a stout black blunt spur; intermediate femora pitchy. Underside castaneous, with the apical ventral segment black; front coxal cavities open; the metasternum transverse, with a narrow longitudinal impression in the middle; the ventral segments about equal to each other, feebly punctured, with scattered pubescence.



UGANDA: Kampala, 17. xi. 1923; four specimens (*H. Hargreaves*).

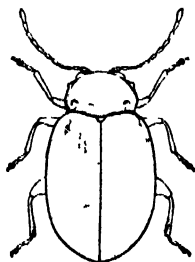
Evidently a variable species, one female being almost entirely castaneous, with only a faint trace of the black apical marking. The smallest species at present known from Africa.

*Crepidodera sulcata*, sp. n. (Fig. 7.)

Fulvous, with the exception of the seven terminal joints of the antennæ, which are fuscous, and the elytra metallic blue; prothorax very finely punctured, with a deep and broad transverse sulcus at the base, not extending to the sides; elytra punctate-striate. L. 2.50 mm.

Head and labrum fulvous, impunctate; antennæ not quite extending to the middle of the elytra, the four basal joints fulvous and the seven terminal joints fuscous, the two basal

Fig. 7.



*Crepidodera sulcata*, sp. n.

joints more thickened and the third to the tenth about equal to each other, with the terminal joint longer and tapering. Prothorax fulvous, finely punctured, transverse, nearly twice as broad as long; the sides marginal and nearly straight, but slightly contracted in front, with the anterior angle acutely produced; a broad and deep sulcus at the base, not reaching the sides. Scutellum fulvous and impunctate. Elytra wider at the base than the prothorax, metallic blue, rather feebly punctate-striate. Underside and legs fulvous, with the ventral segments about equal to each other.

SIERRA LEONE: Njala, 14. vi. 1925; two specimens (*E. Hargreaves*).

Allied to *C. peringuayi*, Jac., from S. Africa, but easily distinguished by its smaller size, all the legs fulvous, the much deeper and broader sulcus at the base of the prothorax, and the striæ of the elytra not so well defined.

LVI.—Note on a new Species of *Pheretima* from Rangoon.

By G. E. GATES, Rangoon, Burma.

*Pheretima planata*, sp. n.

*Description of the Type-specimen.*—*External Characteristics.* Length 116 mm. Diameter in the widest part 4 mm. Number of segments 142. Colour: dorsally bluish grey, slightly deeper anterior to the clitellum, ventrally greyish. The clitellum is greyish brown.

Anterior to the clitellum the worm is flattened dorso-ventrally.

The prostomium and the anterior part of the first segment are withdrawn into the buccal cavity.

There are two secondary furrows on each segment from v. to xiii., one anterior to and the other posterior to the setæ of the segment. Similar furrows are present on the segments posterior to the clitellum, but do not mark off a conspicuous seta-bearing ridge.

The first dorsal pore is in 11/12.

The setæ begin on segment ii. None are noticeably enlarged either anterior or posterior to the clitellum, and the intersetal distances are practically the same all around the segment. The setal circles are uninterrupted by either dorsal or ventral breaks. In the preserved worm the setæ hardly project at all, and hence the worm is unusually smooth to the touch for a *Pheretima*.

The clitellum extends from 13/14 to 16/17 (3). It is ring-shaped and complete on all the segments. Setæ are present, but the dorsal pores are lacking.

In the setal circle of xviii. are two slit-like apertures. Between these apertures are ten setæ. Each aperture is surrounded by a circular lip on which there are no setæ, but which is not sharply marked off from the rest of the segment. The slit lies in the direction of the setal circle. The aperture passes through a narrow neck, with the anterior and posterior margins nearly in contact, into a large circular chamber with a dome-shaped roof. On the roof are several minute round papillæ bearing at their centres pores, which are the openings of the ducts from the glands of xvii. and xix. A slightly larger whitish papilla bears at its centre a tiny opening which is probably the male pore, as the thin ectal end of the prostatic duct passes into the wall of the chamber just behind this papilla.

The female pore is a conspicuous but small opening at the

bottom of a circular depression on xiv. It is in line with the setæ of that segment.

The spermathecal pores are in the lateral line, two pairs, in 6/7 and 7/8. There are two, three, or four minute round greyish papillæ close to the intersegmental furrow in the region of each spermathecal pore. There are no other genital markings.

*Internal Anatomy.* The septa are present from 4/5 on with the exception of 8/9 and 9/10, which are absent; 5/6, 6/7, and 7/8 are slightly thickened.

The gizzard is laterally flattened, slightly conical at the anterior end, with an enlarged rim at the posterior end. The intestine begins in xv. On the left side a cæcum passes from xxvii. forward into xxv. On the right side the cæcum is confined to xxvi., bent up along the side of the intestine with the free end turned forward dorsally.

There are three pairs of commissures in the combined gizzard-segment. The most anterior pair is small. The right commissure of the second, which belongs to ix., is very small, but the left vessel is large, as are also the vessels belonging to x. The last heart is in xiii. No red masses of acinous blood-glands such as occur in *Pheretima posthuma* are present in v. or vi. Lymph-glands are present, small.

The usual nephridial masses on the anterior faces of 5/6 and 6/7 are present.

Testis-sacs two pairs, one each in x. and xi., the anterior pair close up under 10/11. The two sperm-ducts of a side come together in xii. Seminal vesicles two pairs, one each in xi. and xii., those of a segment in contact dorsally over the dorsal blood-vessel, smooth-surfaced, edges incised, but not lobed. The prostates lie in segments xvii.-xxi. and are much lobed. There is a large dome-shaped chamber in xviii., filling the space between 17/18 and 18/19. Anterior and posterior to this chamber, in segments xvii. and xix., are roundish glandular masses. Each mass at first sight appears to be a single gland with a single duct passing forward or backward, according to segment of the mass, on to the roof of the chamber in xviii. If one of these "glands" is examined in a drop of glycerine or lactophenol under the microscope it is readily seen to be an aggregate of smaller glands, each of which has its own duct. These glandular masses are grouped together in the posterior part of xvii. and the anterior part of xix., and the grouped masses are covered over with connective tissue. Close to the septa in this region are strong iridescent muscular bands, passing from the lateral to the ventral parietes. The prostatic duct rises from the outer edge of the dome-shaped chamber,

passes forward on the roof, and at the anterior edge bends in such a way as to form a U-shaped bend with the limbs close together and the opening of the U directed posteriorly. At a point opposite its appearance from the roof of the chamber, the outer limb bends downwards and passes underneath itself to turn outward again, after receiving the sperm-duct, into the prostate gland.

The ovaries are rather unusual in appearance, being smooth-surfaced ovoid-shaped bodies attached by the broader base to the usual place on the posterior face of septum 12/13. The ova inside are irregular in shape. The oviduct funnels are small, in the usual place.

The spermathecae (text-fig. 1) are two pairs, one each in vii. and viii. The duct is shorter than the ampulla, from

Fig. 1.

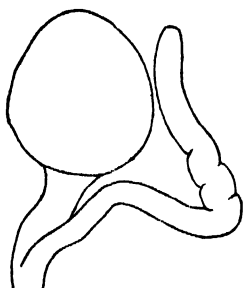


Fig. 2.



*Pheretima planata*, sp. n.

Fig. 1.--Spermatheca,  $\times$  ca. 15.

Fig. 2.--Gland accompanying spermatheca,  $\times$  ca. 15.

which it is clearly marked off. The ampulla is oval in outline and the surface curiously wrinkled. A single diverticulum arises from the inner side of the duct close to the base, the ental half is slightly thinner but much less transparent than the ectal half. The length of the diverticulum is greater than the combined lengths of the duct and ampulla. Internal to the spermathecal duct one, two, or three flattened glands (text-fig. 2) with enlarged ental ends pass into the body-wall separately from each other and from the spermathecal duct. These glands are not quite as long as the spermathecal diverticulum.

*Distribution.* Rangoon, during the months of September (1924), August (1925).

*Remarks.* Six other specimens are 128–176 mm. long, 4–5½ mm. in diameter, with 85–115 segments. The prostomium in all specimens is withdrawn into the buccal

cavity. In one specimen a minute weak spot in the dorsal body-wall resembling a dorsal pore is visible in 10/11. Four specimens have twelve setæ each between the apertures on xviii., one has thirteen setæ. The typhlosole is small and ends about 30 mm. from the posterior end of the worm. The spermathecal ampulla may be oval, circular, or heart-shaped in outline. The prostatic duct always has the U-shaped appearance, but in several specimens the opening of the U is anteriorly instead of posteriorly. The commensures of segments ix.-xiii. all pass into the ventral vessel.

This worm differs in one important respect from all other species of *Pheretima* hitherto recorded from India, Burma, and Ceylon, as it is the first species to be recorded from this region having two pairs of spermathecal pores in 6/7 and 7/8. A number of species of this genus with similarly located spermathecal pores are recorded by Beddard in his Monograph and by Michaelsen in the 'Tierreich' volume on the Oligochæta. The present species differs from all such in points of specific importance. Other species of this genus have been described since the publication of the works just mentioned, but to many such descriptions the writer does not have access.

Burma is frequently said to belong to the *Pheretima* "domain." There have been up to this time thirteen species of *Pheretima* recorded from Burma, exclusive of the Andaman and Nicobar islands. These are :—

- Pheretima feæ* (Rosa). Recorded by Rosa from Kawkaireit.  
 — *birmanica* (Rosa). " " " Bhamo.  
 — *carinensis* (Rosa). " " " Meteleo.  
 — *bournei* (Rosa). " " " Cobapo.  
 — *peguana* (Rosa). " " " Rangoon.  
 — *houletti* (E. Perr.). " " " Palon.  
 — *andersoni*, Mich. " Mich. from Amherst.  
 — *heterochæta* " " " Mañchio.  
 — *lignicola*, Steph. " Stephenson from Thinganyinyaung to Myawadi.  
 — *posthuma* (L. Vaill.). Recorded by Stephenson from Yenangyoung, Magwe, Northern Shan States.  
 — *anomala*, Mich. Recorded by Gates from Rangoon, Insein, Thonze, Zigon, Prome, Bassein, Pyapon.  
 — *insolita*, Gates. Recorded by Gates from Rangoon, Insein, Bassein.  
 — *planata*, Gates. Recorded by Gates from Rangoon.

Of these, *peguana*, *houletti*, *heterochæta*, *lignicola*, and *posthuma* are peregrine, and of little or no value for zoogeographical discussions. Perhaps *P. anomala* should be added

to this list, but, as it has been found outside of Burma only in the Botanical Gardens of Calcutta, it is possible, if not probable, that it was carried to that place in botanical shipments from Burma. Worms have been carried in this way much longer distances. Of the remaining eight endemic worms only three occur in Rangoon and the immediate vicinity. These are *P. anomala*, *P. insolita*, and *P. planata*, and none of these three is very common.

In contrast with these three uncommon endemic *Pheretima*, there have been recorded from Rangoon eight endemic species of the subfamilies Moniligastrinae and Octochætinae, some of which are very common. So far, then, as Rangoon city and its immediate vicinity is concerned, it is hardly possible to call it *Pheretima* domain.

#### LITERATURE.

- BEDDARD, F. E. 1895. "Monograph of the Order Oligochæta." Oxford.  
MICHAELSEN, W. 1900. "Oligochæta." 'Das Tierreich.' Berlin.  
STEPHENSON, J. 1923. "Oligochæta." 'Fauna British India' Series. London.

#### LVII.—*Observations on some British Species of Sponges belonging to the Genus Reniera.* By MAURICE BURTON, M.Sc.

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THE story of the variability of the sponges growing in the littoral zone, as recounted in the following pages, furnishes, to my mind, a very pretty study in variation, and presents to the systematist a valuable guide to a better understanding of the group as a whole. Startling as my observations and conclusions may appear, they are no more remarkable than the variations which I have observed in more than a score of other species, accounts of which I hope to publish in due course. It must be confessed that the following results surprised me not a little, and I should still be in doubt as to the accuracy of my deductions had I not examined the evidence again and again, and, still more important, received corroboration in a number of parallel but independent cases.

Of all groups of sponges there is none to rival the Haploscleridæ in the utterly hopeless state of confusion of the classification or in the multiplicity of its genera and species.

As an indication of the state of chaos into which it has sunk, one need only draw attention to the fact that writers have, from time to time, found it impossible to refer given specimens to their correct species, and have preferred to leave them unnamed rather than add to the already existing confusion (*cf.* Hentschel 1912, Stephens 1912, 1921, etc.). Nevertheless, when one takes a comprehensive survey of the group, it becomes abundantly clear that the difficulty of distinguishing one species from another is apparent rather than real, and is due more often to misconceptions of earlier writers than to actual obstacles on the part of Nature. This is particularly true of the genus *Reniera*, and in the following pages I hope to make it clear that upwards of a score of species referred by Bowerbank (1874, 1882) to the genera *Isodictya* and *Halichondria*, and belonging more properly to *Reniera* and *Chalina*, express, in reality, nothing more than the normal variations within a single species. My observations are based upon the examination of large numbers of specimens from the British coasts, together with quite a number of others from various parts of the world. Moreover, I have carefully compared the variability of this species with that of others, both closely- and distantly-related. Amongst other things, my observations expose the fallacy of determining species by means of isolated specimens.

If we examine Bowerbank's (1874 B, pp. 275-76) statements, we learn that the first four species of his genus *Isodictya* (*I. cinerea*, *I. permollis*, *I. peachii*, and *I. simulo*) were originally referred by Johnston to one species, *Halichondria cinerea*. Bowerbank, while admitting the apparent identity of all four specimens with each other, separates them solely on trifling variations in size of spicules. In view of the admittedly variable limits in size of sponge-spicules, can anything be more misleading? These four species I propose to regard as one, *Reniera cinerea* (Bwk.), since the genus *Isodictya*, with *I. palmata* (Johnston), Bwk., as the type-species, is reserved for a different class of sponge (*vide* Dendy, 1924). Dendy's (1916 A, p. 109) and Stephens's (1921, p. 7) suggestions may be accepted as correct, therefore. Accordingly, we now have a species whose form may be encrusting, massive, or subramose, and whose colour is pale purple or lilac in life, brown or yellow in the dried state. In my own specimens I have some, agreeing in form, colour, habitat, etc., in which the skeleton contains more spongin than usual. They are, in fact, readily referable to the genera *Chalina* or *Pachychalina*, or even, in some cases,

*Ceraochalina*. This need occasion no surprise, in view of my observations already expressed elsewhere (Burton, 1926). It is a very curious fact that spongologists can contemplate the addition of more silica to the spicules of a certain sponge, thus increasing their size, or the variable quantity of spongin composing the fibres of a Euceratose sponge, or the presence or absence of spongin in the skeleton of a given species in some other group of sponges, and regard them as of no taxonomic importance, yet when dealing with the Haploscleridæ are prepared to define genera on the relative proportions of spongin present as in *Reniera*, *Chalina*, *Pachychalina*, or *Ceraochalina*. I have no doubt at all that the transition from one to another of these genera, as hitherto understood, may occur within a single species as a normal variation. I shall return to this point again later.

Except for the occurrence of styli among the more normal oxea, a not unusual thing, *I. varians* differs in no essential detail from *R. cinerea*, nor does *I. elegans*, but for the fact that the colour in the living state was not observed. *I. mucandrewii* differs only in the slightly larger size of the spicules and in the slightly larger and more fistulous character of the vents, the latter, again, a negligible point (*vide infra*), while *I. rosea* could be confidently regarded as a synonym of *R. cinerea*, but for the colour, which is a rose-pink as against lilac or pale purple. The differences between these three colours are very slight. Since the question of the taxonomic value of colour is raised, it may be worth while to append my own observations on these forms. Generally the colour ranges from yellow to a reddish brown, some specimens, however, are a dull green, others rose-pink or purple. Further, in a number of examples of *Chalina oculata* from the same locality a similar range of variation was found, from yellow to green, rose-pink, and purple. In the *Reniera*-forms, moreover, the shades of colour found graded easily from one to the other. Among those of a reddish hue some were yellow tinged with pink, others pink, some a deep blood-red or only reddish brown—in fact, I do not make an extravagant claim when I suggest that sufficiently assiduous collecting would enable the collector to obtain specimens, similar in external form, in which the various shades of colour would pass insensibly from one to the other of any of the colours referred to. In some cases the colour was completely lost on drying, in others partially or not at all. Immersion in spirit usually results in total loss of colour. Since these observations coincide with those of other authors and with my own on different species, I



propose to regard the colour in this species, at all events, as of little value to the systematist—rather it provides a field for the combined activities of the naturalist and the biochemist.

In *I. simulans* the general appearance differs little from that of *R. cinerea*, but it is more branched and the colour ranges from dull green to dusky brown. Stephens (1921) records the finding of it as thin encrustations or branching masses, often growing into "more erect, rounded, and anastomosing branches," ranging from rusty brown to greyish brown or grey. Clearly, the colour in these forms is not constant. On the other hand, the same author (1912, p. 24) found that *R. peachii*, which she rightly regarded as a possible synonym of *R. cinerea*, grew in cushion-like or branching masses. Surely two species so similar, from identical habitats and localities, separated by such trivial differences, can no longer be regarded as separate?

*I. mammeata* differs only from *R. cinerea* in the cream-white colour and mammiform vents, but, according to my own observations, I find it possible to take two specimens, identical in all other respects, and observe in one only mammiform vents and in the other vents level with the rest of the surface. A third specimen may possess both kinds and, in addition, fistulous vents. It is clear also that all three types of vent may be easily derived the one from the other by a slight difference in the degree of development of the oscular margin. Further, the diameter of the oscules in any of the three types may vary from 1–3 mm. or more in diameter.

Both *Halichondria mcintoshii* and *Isodictya densa* differ from the foregoing only in colour, here brown, that it forms a thinner incrustation, and that there is slightly more spongin around the primary fibres. *I. gregorii* is but a thinner incrustation still.

*I. ramusculus*, a light lake, rosy-violet, or pale violet in colour, differs from *I. rosea* only in the slightly greater development of spongin. Indeed, their author separated them on size of spicule only. Mammiform oscules are here of occasional occurrence! (*vide* Bwk. 1882, p. 115).

*I. clava* is merely an immature form of the same species, while *I. luteosa* is a closely-allied form which has become mixed up with the branches of a *Fucus* sp., a not uncommon occurrence in littoral sponges, while *Halichondria regularis* is only a malformed example of *R. cinerea*.

*I. ingalli*, according to some notes made by Carter after examining the type-specimens, is synonymous with

*I. simulans*, an opinion with which I agree, and, further, I can consider *Halichondria condensa* only as a slightly more robust specimen of the same species. Again, *I. pallida* represents this robust growth taken a stage further.

Regarding *I. fistulosa*, white with a tint of pink, I need only quote Bowerbank (1882, p. 122), "I also found a specimen of *Isodictya fistulosa*, which in some cases might be readily confounded with *I. mcandrewii*." The latter species I have already discussed, and, since the only difference between *I. fistulosa* and the rest is the slightly more fistulous nature of the vents, I think we need not hesitate to regard it also as a synonym of *R. cinerea*.

For the rest, *I. dichotoma* and *I. pygmæa* are similar to all the foregoing, except that the skeleton is more nearly that of a *Chalina* and that they are of more erect growth. This raises a rather interesting question which I hope to discuss later.

So far I have not stressed my own observations, but have been content to discuss Bowerbank's species largely on their own merits, for I feel that a comparison of his figures and remarks, together with the other evidence at our disposal, leads one inevitably to the suspicion that all the species of *Isodictya* I have discussed are extremely closely related. As already mentioned, I have collected numerous examples of these forms from a strip of beach at Littlehampton about two miles long. In this collection I have been able to duplicate practically every one of the species here discussed, while, in addition, there are so many intermediate forms as to leave no doubt in my mind that the external forms of all species are but the shapes assumed by individuals of a single species growing in slightly different positions and subject to the usual variations in the rate of nutrition, etc. This remark applies even to *I. pallida*. Had I, in naming fresh species, used Bowerbank's methods, it would have been necessary to erect upwards of a hundred such species. According to remarks in Carter's MSS., he regarded that author's liberality in naming his species in much the same light as I do—that it is absurd.

It is interesting to note that *Halichondria panicea*, which also grows in profusion along the Littlehampton beach, varies in external form in almost exactly the same way as *Reniera cinerea*, as here understood, ranging from thinly encrusting, massive, ramose, branching to spherical (one specimen about 10 cm. in diameter). The following remarks may be applied to both species, with this reservation that the growth is on the whole more robust in the former:—

The sponge may be thinly incrusting, massive, ramose, or composed of cylindrical branches which may remain separate or may anastomose. From the main portion of the sponge short erect branches may arise. The oscules may be small with the margins level with the general surface, papillose or fistulous, always with a greatly varying diameter. Often the vent may be chimney-like with the openings of the true oscules arranged around the inner face in the manner of a *Siphonochalina* (cf. Bowerbank, 1874 n, pls. xxxix., xl.). The pores vary in size, so that the tessellated appearance of the surface is not constant. In one case two specimens were so similar in appearance that I took them to be identical the one with the other, but, on examining them microscopically, I found that one was *Halichondria panicea* with smaller pores than usual so that the characteristic reticulate surface of this species was inconspicuous, while the other was *Reniera cinerea* with larger pores than usual so that the surface exactly simulated the *Halichondria*. In both species where cylindrical branches occur, the oscules tend to arrange themselves in linear series along the margins of the branches.

A further relevant note in Carter's MSS. concerns Bowerbank (1874 n, pl. lxviii.). Referring to *Chalina grantii*, he says, "Here again, excepting the form of the spicule, which goes for nothing, this might be figs. 1, 3, or 4, or any of the soft ones." Figs. 1, 3, and 4 are the external forms of *Chalina flemingii* and *C. montaguii*, and I agree with Carter that the three species are synonymous. Moreover, since *Reniera cinerea* may develop sufficient spongin to be called a *Chalina*, the external forms of Bowerbank's Chalinas are sufficient to show that they are synonyms of that species. Ferrer (1914 c) relegates *Chalina montaguii* to *Pachychalina*, thus supporting my contention that *Pachychalina* is but one degree removed from *Chalina* and, as at present understood, not logically separated from it. The "soft ones" referred to by Carter are *Chalina limbata* and *Chalina gracilentia*, which he rightly regarded as two forms of one species only, and, moreover, was inclined to regard them as aborted growths of the other Chalinas. This latter I disagree with, since Stephens has apparently been able to identify them by characters which do not warrant their inclusion among any of the Isodictyas or Chalinas I have discussed. Accordingly, I prefer to retain *Chalina limbata*, or *Pachychalina limbata* according to Stephens (*l. c.*) be it noted, as a distinct species.

Assuming now that my Littlehampton specimens are

individuals representative of the variations in *Reniera cinerea*, it will be of value to append here some of my observations on the construction of the skeleton.

In those which could be confidently assigned to the genus *Reniera*, as hitherto understood, the skeleton was found to vary enormously in the size, shape, and disposition of the spicules. A group of ten specimens was taken, practically identical in external form and colour, which could be placed in one or other of the following categories, following the arrangement of the spicules:—

(a) Skeleton subisodictyal, unispicular, with tendency to form triangular meshes, spongin only on ends of spicules.

(b) Skeleton isodictyal, unispicular, with spongin usually, but not wholly, confined to the ends of the spicules.

(c) Skeleton isodictyal, primary lines multispicular (2–6 spicules), secondary lines unispicular, spongin chiefly confined to ends of spicules or forming at most a delicate sheath around the primary lines.

(d) Skeleton isodictyal, primary and secondary lines both multispicular, spongin as in (c).

(e) Any of the foregoing, more usually (c) or (d), may be further modified by the presence of a number of loose spicules between the meshes of the main skeleton, giving the skeleton a Halichondroid appearance (*cf.* Dendy, 1921 B, in *Chalina confusa*).

The spicules are oxea which may be straight or curved, stout or slender, sharply or bluntly pointed. Often they are replaced by styli, more rarely by strongyla, sometimes isolated oxea, here and there, are centrotylote. The length of the spicules varies from about .080 to .150 mm., the thickness from .004 mm. or less to .012 mm. Spicules from one part of the sponge may be of the larger size, while those from another part 2 cm. away will be of the smaller size. Frequently in sections it appears that the spicules fall into two distinct categories, large and small, but other sections from different parts of the same sponge show that this is not true for the whole sponge, and may, I think, have something to do with the growth of the sponge at that point. Just as the spicules vary from one part of the sponge to another, so does their arrangement and also the quantity of spongin associated with them. Often thick isolated patches of spongin may be seen (*cf.* Stephens, 1921, p. 8).

The remainder of my Littlehampton sponges could be distributed among the genera *Chalina*, *Pachychalina*, and *Ceraochalina*, yet in form and appearance they were almost indistinguishable from the *Reniera*-like forms. It is easy to

see how they can be derived from the latter. A *Reniera* with skeleton (a) or (b), by the addition of a little more spongin so that it coats the whole spicule, would become a *Chalina*; with more spongin, especially if the spicules be fine and slender, it would become a *Ceraochalina*. With skeleton (c) or (d), with the addition of more spongin, the individual becomes a *Chalina* or *Pachychalina* according to whether there are few or many spicules side by side in the primary lines. Need we comment further on the inadequacy of our previously accepted ideas concerning these four genera?

Other species which must be regarded as synonymous with *R. cinerea* in its widest sense are *Chalina subarmigera* (Ridley), *R. clathrata*, Dendy (1895), and *Lessepsia violacea*, Keller, *Isodictya filamenta*, Bwk., may probably be regarded as a synonym, but with so small a specimen it is impossible to say more. Such a specimen should never have been made the type of a new species.

*Chalina oculata* is a very closely related species, differing only in the habitat and bathymetric distribution. It is a problem, both interesting and instructive, as to whether this species may not be a deep-water form of the littoral species *R. cinerea*. For the moment the idea is no more than a suspicion, and there I will leave it until a wider study enables me to speak with greater certainty.

Since committing the foregoing to paper, I have had the good fortune, through the kindness of the British Museum authorities, to re-examine the sponges of the Bowerbank Collection, including the types of the species mentioned above. The results are most gratifying. Among the sixteen specimens identified by that author as *Reniera cinerea*, I was able to find all the types (a-e) of Renieroid skeleton described above. The spicules ranged from .080-.160 mm. In eight specimens each of *R. peachii* and *R. permollis* similar variations in size and arrangement of spicules occurred, while in all three species the amount of spongin present varied considerably, the extreme being reached in a specimen of *R. peachii* which was definitely a *Ceraochalina*. Two of his specimens of *Isodictya varians* were truly Chalinoid. So was it with the remainder, the variations in the various specimens of each of the species of *Isodictya* here discussed were of such a nature in each case. Further, the type-specimen of *Chalina flemingii* is a true *Ceraochalina*, but with patches of the skeleton in various parts of the sponge arranged as in a true *Chalina*, according to our present ideas concerning these two genera, while another specimen was wholly a *Chalina*.

Again, the type-specimen of *Chalina limbata* is a *Cerao-chalina* with the spicules reduced to extremely fine needles arranged uniseriably at the centre of thick spongin-fibres, while the type of *Chalina gracilentia* is a typical *Pachychalina*, although the other examples of this species identified by Bowerbank range from a typical *Chalina* to a typical *Cerao-chalina*.

Since writing my observations on the quantitative relation between spongin and spicule, I have seen yet another case which serves to emphasize them. In the specimens of *Chalina palmata* described by Dendy and Frederick (1924) the skeleton varies from that of a *Pachychalina* to that of a *Cerao-chalina*, although they are identical in all other respects. The question naturally arises as to how far our knowledge of the formation of siliceous spicules and spongin-fibres fits in with the observed variations between the two forms of skeletal matter. In the first place, we know that spicules vary in size in the different parts of a single sponge, in sponges in the same locality, and more still in sponges of the same species found in widely differing localities. The spicule itself, at all events in a large spicule where observation is relatively simple, consists of an organic centre surrounded by concentric layers of colloidal silica, the consecutive layers being separated by a sheath of organic matter, while the whole spicule is surrounded by an organic sheath. Moreover, a certain quantity of organic matter is associated with the silica (*vide* Sollas, 1888 B, pp. xlvii.-xlvi.). Bidder (1902) suggests that the variation in size of spicule is the result of a varying temperature, and there is much to support this. Secondly, the spongin-fibres are composed of a thin central core, possibly of organic matter, surrounded by concentric layers of spongin. May not the amount of spongin deposited also depend upon temperature? If Dendy's theory as to the origin of the protozoan be correct, is it not feasible that the organic centre of a spongin-fibre may be due to the same cause? I feel tempted to suggest that the organic layers between the concentric layers of silica in a siliceous spicule may be closely allied to, if not identical with, the spongin of the fibres. However, in the absence of precise knowledge, it will be convenient to ascribe two factors to sponges, a spongin- and a spicule-forming factor, one or other of which may be absent or one dominant and the other recessive, according to the species and the individual under discussion. It is not unreasonable, then, to assume that, under suitable changes of environment, such as temperature, that, when the two factors are present, their relative activity differs.

Thus under given conditions in a Chalinine sponge more spongin than spicules would be formed, giving rise to a Ceraochalinoid skeleton, while, *vice versa*, a Renieroid or Chalinoid skeleton would be formed. A sponge living under conditions which gave increased activity to both factors would be Pachychalinoid. It is noteworthy that in the warmer waters of the world the Ceraochalinoid condition is more prevalent, and, to use an analogous case, the Euceratosa of more frequent occurrence. However, this is pure speculation, and does not affect the result of observed facts that the relation between spongin and spicule in a given species is variable, and that our classification of the Renierinæ and Chalininæ must be modified accordingly.

#### LIST OF LITERATURE REFERRED TO.

1902. BIDDER, G. "Notes on Plymouth Sponges." Journ. Marine Biol. Ass. vol. vi. no. 3, 1902, pp. 376-382.
- 1874 B. BOWERBANK, J. S. A Monograph of the British Spongiadæ. Vol. iii. London.
1882. —. A Monograph of the British Spongiadæ. Vol. iv. London.
1926. BURTON, M. "The Relation between Spongin and Spicule in the Haploscleridæ." Ann. & Mag. Nat. Hist. ser. 9, vol. xvii. pp. 265-267.
1895. DENDY, A. "Catalogue of Non-Calcareous Sponges collected by J. B. Wilson, etc." Part 1. Proc. Roy. Soc. Victoria, vol. vii. pp. 232-260.
- 1916 A. —. "Report on the Non-Calcareous Sponges collected by Mr. James Hornell at Okhamandal, etc." Rep. to the Government of Baroda, etc. Part 2, pp. 93-146. London: Williams and Norgate.
- 1921 B. —. "Report on the Sigmatotetraxonida collected by H.M.S. 'Sealark' in the Indian Ocean." Trans. Linn. Soc. London, vol. xviii. part 1, pp. 1-164.
1924. —. "Porifera. Part 1. Non-Antarctic Sponges." British Antarctic ('Terra Nova') Expedition, 1910. Zoology, vol. vi. No. 3, pp. 269-392.
1924. DENDY, A., and FREDERICK, L. M. (Miss). "On a Collection of Sponges from the Abrolhos Is., etc." Journ. Linn. Soc., Zool. vol. xxxv. pp. 477-518.
- 1914 C. FERRER, H. "Esponjas de Cantalica" Parte Segunda. Trab. Mus. Nac. cienc. nat. Madrid, Ser. Zool. no. xvii. 1914.
- 1912 A. HENTSCHEL, A. "Kiesel- und Hornschwämme der Aru- und Kei-Inseln." Abh. Senckenberg nat. Ges. Bd. xxxiv. pp. 291-448.
- 1888 B. SOLLAS, W. J. "Report on the Tetractinellida." 'Challenger' Reports, Zoology, vol. xxv.
- 1912 A. STEPHENS, J. (Miss). "Clare Island Survey. Part 59. Marine Porifera." Proc. Roy. Irish Acad. vol. xxxi. no. 59.
1921. —. "Sponges of the Coasts of Ireland. II. The Tetraxonida" (*concluded*). Fisheries, Ireland, Sci. Invest. 1920, ii.

# THE ANNALS

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LVIII.—*Ancestrulæ and Frontal of Cheilostomatous Bryozoa.*  
—Part IV. By ARTHUR WM. WATERS, F.L.S., F.G.S.

[Plates XVII. & XVIII.]

To the shortened references already given, add :—

Smitt, "Krit. fört. öf. Skand. (Hafs Bryozöer)," Öf. k. Vetensk. Akad. Förh. 1867.

Canu and Bassler, N. Amer. (Early Tert.) Bry. 1920.

- Lepralia pallasiana*, Moll., p. 425.
- (1) — *eliminata*, Waters, p. 428.
- Peristomella sauroglossa*, Lev., p. 428.
- Mucronella coccinea*, Abild., p. 431.
- (2) *Escharella labiata*, Boeck, p. 431.
- Inversula inversa*, Waters, p. 433.
- Schizoporella crustacea*, Sm., p. 434.
- *divisopora*, Waters, p. 437.
- Micropora fissurata*, sp. n., p. 436.
- Frontal Wall, p. 497.

*Lepralia pallasiana*, Moll.\*.  
(Pl. XVII. figs. 1-8; Pl. XVIII. fig. 11.)

Shortly before my leaving Santa Margherita, Riviera di Levante, Italy, a steam trawler had been moored on the

\* Canu and Bassler, *Cryptosula* (gen.), "Les Bryozoaires du Maroc," Mém. Soc. Sc. Nat. Maroc, vol. x. p. 32 (1925).



beach, ready for painting and repairs; and examination showed that below the water-line it was almost entirely covered with Bryozoa, of which the greater part was *Lepralia pallasiana*, with a few *Schizoporella unicornis*, a specimen of *L. otto-muelleriana*, and some *Bugula neritina*. *L. pallasiana* had not been met with in the winter in Santa Margherita, and therefore it seemed that the ship must have been moving about in other waters further south, probably Sicily or the Adriatic.

Upon enquiry from the local fishermen, I found that it had been in Venice, no doubt fishing between there and the North Italian coast, probably principally in the Adriatic. They said that it would not have been in the water more than twelve months, but their information could not be checked. The ship badly required repainting, and with being on the beach for some time it was very dry, so that, by putting a knife under the paint to peel it off, a quantity of the disk-like colonies could be removed whole.

Some of these, but not all, were seen by the naked eye to have a number of short radiating lines (Pl. XVII. fig. 1), which further examination showed were caused by the imperfect calcification of the vacant places; in these parts there is no calcification, or only partial, of the basal wall, the front is usually quite open or there may be a ghostly commencement.

It was then found that in various places there were several of what I have called blind zoecia, having a small round opening above the middle of the frontal, surrounded by a raised ridge, and there are also radial ridges, so that it resembles the frontal of *L. otto-muelleriana*, Moll. In many cases where these blind zoecia occur, the following zoecium is imperfectly formed, originating a vacant space, as I have seen in three spaces near together, though there are vacant spaces without any blind zoecium at the proximal end, and they may occur elsewhere.

Perhaps the riddle \* receives some partial explanation by sometimes finding above a blind cell a very wide zoecium (Pl. XVII. fig. 4) whose growth is seen to be started by two or more zoecia by the side of the blind cell (Pl. XVII. fig. 6). Apparently no mesenchymatous tissue from the distal end of the blind zoecium helps in the growth. The wide zoecia have a wide and large opercular opening, in some opercula

\* Canu and Bassler (Early Tert.), p. 83, fig. 28 A, figure a blind (sealed) zoecium.

there may be a partial division up the middle, and at each side of the proximal line there is a thickening like the base of an operculum. These blind zoœcia evidently cause a disturbance of growth in various ways, and we may say that they are not fertile at the distal end. There are often from the front of the zoarium irregular erect bilaminated growths of different shapes, sometimes short and straight, sometimes cup-shaped.

A very interesting point is that the New South Wales specimens of this species have similar vacant spaces. Although it has not been generally recognized from the southern hemisphere, yet it appears to be fairly widely distributed, having been known as *Lepralia torquata*, Q. & Gaim., as I have for some time recognized.

In the vacant spaces there is, as a rule, the failure of one row of zoœcia, and distally to the vacant spaces the two outside rows turn inwards and meet (Pl. XVII. fig. 2). The dorsal wall is wanting in a part of the vacancies, and when it is formed again there is a growth from each side which may join in the middle (Pl. XVII. fig. 8).

Blind zoœcia\* are known in various genera having the frontal wall with similar characters to those of the perfect zoœcia, as in Cribrilinidæ, to which I refer under *Puellina innominata*, var. *vicariata*, Wat., and discuss the unnecessary genus *Distancesharella* of d'Orbigny, showing that in Cribrilinidæ there are frequently zoœcia without an oral opening, but with the ornamentation of the ordinary zoœcia. In the Adeonellidæ blind zoœcia are very common often with one or more avicularia. There may be large patches of blind zoœcia, and the whole subject requires further study. Besides the blind zoœcia with the frontal ornamentation, there are many Cheilostomatous Bryozoa having blind zoœcia quite smooth with or without a large central pore. Canu and Bassler mention some with a mark like an opercular mark, as in *Conopeum similior*, C. & B., pl. ix. fig. 8; *Hincksina oculiensis*, C. & B., pl. xxii. fig. 13.

Near the growing-edge of the zoarium there is first a membrane, and round the pore-spaces the calcareous wall gradually grows over the membrane, as can be seen at the border; gradually between these pores calcareous ridges arise, tubercles being formed in places. Round the pores there is a circle of thicker deposit as we have seen in Cribrilinidæ, and it is specially pronounced in *Hiantopora monoceros*,

\* "Cribrilinidæ," p. 559, pl. xvii. fig. 3.

Busk. It is figured by Norman, "Nat. Hist. Finmark," Ann. & Mag. Nat. Hist. ser. 7, vol. xii. pl. viii. fig. 13, in his *Gephyrotes punctata*, pl. ix. figs. 4-6.

*Lepralia pallasiana*, Moll., and *L. otto-muelleriana*, Moll., resemble one another most closely in the zoëcial growth both in the size and in the operculum, but the ancestrula seems to be different, there are no spines in *pallasiana*, but some in *otto-muelleriana*. In the first there are—in Europe, at any rate—no ovicells nor avicularia, thus differing in several important characters. Further, *pallasiana* has pores over the surface, surely a tremocyst, while *otto-muelleriana* has a pleurocyst. Canu and Bassler put these to *Hippodiplosia* and say a tremocyst. In the growing-edge of *L. otto-muelleriana* \* a zoëcium with the plain calcareous layer only partially formed has some pores without any buttress being formed (Pl. XVII. fig. 1). Later on there is, from each marginal pore, a calcareous growth over the holocyst as shown by me. Pores are later formed on the first calcareous layer, and then round them there is a tubular growth, as described by me as forming spinous processes in *L. pallasiana*, var. *projecta*, W.

*Lepralia eliminata*, Waters.  
(Pl. XVIII. fig. 10.)

*Lepralia eliminata*, Waters, "Bry. New South Wales," Ann. & Mag. Nat. Hist. ser. 5, vol. xx. p. 194, pl. v. fig. 3, pl. vi. fig. 22; *op. cit.* ser. 6, vol. iv. p. 13 (1889); "Mar. Biol. Sudan," Journ. Linn. Soc. vol. xxxi. p. 164, pl. xiv. figs. 10, 11 (glands) (1909).

I have found one ancestrula which has the oral aperture somewhat shorter than the other zoëcia. There is a spine at each side, and on the distal border there are two spines directed towards one another. The zoëcia at the growing-edge have four oral spines, but in other zoëcia they are wanting.

*Peristomella sauroglossa* (Levinson).  
(Pl. XVII. figs. 9, 11.)

*Smittia præstans*, Waters, Ann. & Mag. Nat. Hist. ser. 6, vol. ix. p. 17, pl. iii. figs. 9, 11 (1889).  
*Escharoides sauroglossa*, Levinson (Morph.), p. 319, pl. xvii. fig. 5 a, f (1909).  
*Romancheina præstans*, var., Waters, Canu & Bassler (Early Tert.), p. 407, fig. 120 B (1920).

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\* (Oribrulinidæ), pl. xviii. fig. 1.

This was separated by Levinsen from what I had determined as *præstans*, saying at the time that it might have to be named as a variety. They are certainly very closely allied, the chief difference being that *S. sauroglossa* has pores all over the frontal surface, whereas *præstans* has them only at the border as areolæ, but in *sauroglossa* at the growing-edge the very youngest zoœcia only have a single line of pores, though very soon, as seen in specimens from New Zealand and New South Wales, other pores are also formed. The same thing is seen in several Cheilostomata—for instance, *Lepralia soulierii*\*, Calv., at first has only the areolæ, but later there is a thick frontal wall with pores all over the surface. Also *Lepralia rectilineata*, H., has, in the youngest zoœcia, only a row of areolæ, then a second row of pores is formed within the first, and ultimately there may be pores over the central part; *Romancheina martiali*, Jullien, has a very similar frontal, so that it is well-known in what Levinsen called *Escharoides*.

In specimens of *sauroglossa* from New Zealand and New South Wales the proximal part of the frontal is somewhat raised, and round this slightly elevated part are large pores. At first this was not easy to understand, but soon suspicion was roused that it might be an ovicell, which some broken-down pieces soon confirmed. Where the ovicell is forming there is, at the proximal end, a small triangular imperforate wall and there are five or more large triangular pieces. Hincks's figure of the ovicell of *M. præstans* is somewhat similar to that of *sauroglossa*, and the same is the case in MacGillivray's † figure of a fossil. *P. præstans*, Calvet, also shows the same thing in *Smittia præstans*‡, var. *tridens*, Calv.

In the interior distal part of the ovicell there are a number of lines spreading outwards from the base (Pl. XVII. fig. 9). The explanation of this is given by a study of *Micro-porella malusii*, Aud., which has lines from the centre of the base, radiating to the border (Pl. XVII. fig. 10). These are

\* Sir Sidney Harmer, in reference to my "Bry. from Oran," p. 654, has kindly informed me that, in writing (*Morph. Cheil.*), p. 332, there was a momentary confusion between *Umbonula verrucosa* and the genus *Umbonula* including *pavonella*. Therefore, now there is no doubt that Harmer had the ordinary British *verrucosa*, and my long-continued perplexities, through *verrucosa* being described with avicularia, are removed.

† Tert. Poly. of Victoria, p. 98, pl. xiii. fig. 6 (1895).

‡ Expéd. Antarct. Française, p. 30, pl. iii. fig. 6 (1909).

found to be really tubes going to the large pores bordering the ovicell, practically areolæ.

Levinson puts *S. sauroglossa*, Lev., *Romancheina martiali*, Jull., *E. coccinea*, Abild., *E. jacksoni*, Waters, *E. præstans*, H., *E. contorta*, B., *E. larvalis*, MacG., and *E. labiata*, Boeck, under *Escharoides*. Canu and Bassler place *E. præstans*, var. *sauroglossa*, and *E. martiali* under *Romancheina*, pp. 407, 408, but place *præstans*, H., *G. jacksoni*, W., *G. contorta*, Busk, *G. labiata*, Boeck (non Busk), *G. costifera*, Osburn, under *Peristomella*, so that *præstans* and the almost identical var. *sauroglossa* are placed in two different genera. They say of *Peristomella* frontal holocyst, covered by pleurocyst, but of *Romancheina* covered by tremocyst. I propose to drop *Romancheina* and place all under *Peristomella*.

In my opinion we are not justified in using the name *Escharoides* for anything at all, for Milne-Edwards gave the name for a subgenus of *Cellepora*, for "espèces dont les cellules sont rangées sur un seul plan et sont libre ou du moins distinctes dans une grande partie de leur longueur." This means, at present, absolutely nothing, and the genus has never been diagnosed. *Escharoides*, as used by Smitt\*, has an avicularium in the lip of the peristome, and in this sense it has been used by Busk, Norman, and others for two generations, and as this is what has been understood it was not open to Levinson to use *Escharoides* for something quite different, and I fail to understand why he did it. Hincks apparently took *Escharoides* as a genus of Smitt with *E. sarsii* as the type. However, Canu and Bassler do not follow Levinson, but place his species under *Romancheina* and *Peristomella*. Smitt seems, in 1878, to have given up *Escharoides*, and replaced it by *Discopora*.

Levinson (*loc. cit.*), when separating my *præstans* as *sauroglossa*, said that the operculum was divided at the extremity, and thus differed from *præstans*, H. I examined the operculum of specimens of *sauroglossa* from Green Point, Sydney, which may be looked up as a co-type, without finding the forked structure, but the lateral borders are somewhat thickened, whereas the distal is thin and would readily become torn, and it is just as I figured it. In this case the separation of the operculum is very difficult, and spirit-specimens might be more satisfactory. Next an operculum of *præstans* from New Zealand was teased out, also a difficult task with poor material, and it was fairly similar to that

\* (Hafs. Bry.), p. 24, pl. xxvi. figs. 147-154 & 155-159.

from Green Point, and it is difficult to account for the difference from Levinsen's specimen, though I do not forget that my material was not satisfactory. No divided operculum has been described from any other Cheilostome. It therefore seems that with the young *sauroglossa* areolate and the operculum fairly similar, there is not much ground for generic, even if for specific, separation. The avicularian mandibles and the ovicells of *præstans* and *sauroglossa* are quite similar.

The ancestrula of *P. præstans* has thirteen spines; *P. coccinea* has eleven to thirteen; *P. jacksoni*, W., has thirteen spines; *P. labiata* has eleven.

*Mucronella coccinea* (Abildgaard).  
(Pl. XVII. fig. 12.)

A specimen from Naples has an ancestrula with eleven spines round the border. The next zoecium has three spines, the next following ones have four spines distal to the aperture, and a spine on each side of the lyrula. In the second series of young zoecia there is an avicularium on the one side, while in the mature zoecia there is nearly always a pair.

The ancestrula was figured by Smitt, pl. xvii. fig. 162, 163, and by Hincks\*, and in the same work the ancestrula of *M. peachii* is shown, resembling Smitt's figures of *coccinea*. It thus seems that there is a calcareous wall formed over the proximal part. There are some other cases where there are two forms of ancestrula—as, for example, *Microporella malusii*, Aud., *Escharella labiata*, Boeck, *Schizoporella vulgaris*, Moll.,—but the difference does not seem, as a rule, to be very great (see page 432).

*Escharella labiata* (Boeck). (Pl. XVIII. figs. 1, 2.)

*Discopora coccinea*, forma *labiata*, Smitt (Hafs. Bry.), pp. 27, 175, pl. xxvii. fig. 176.

*Phylactella grandis*, Hincks, Ann. & Mag. Nat. Hist. ser. 5, vol. vi. p. 280, pl. xv. figs. 4, 5 (1880).

*Mucronella labiata*, Levinsen (Kara Havet), pp. (19), 323 (1886).

*Phylactella labiata*, Waters (Franz Josef), p. 90, pl. xii. figs. 3, 4 (1900); Andersson, Bry. Exp. Schw. p. 548 (1902).

*Escharella labiata*, Nordgaard, Hyd. & Biol. Invert. p. 170, pl. iv. figs. 25, 26, 31 (1905); Levinsen (edit. by Jensen, Nordgaard), Danmark Eksped. til Grønland, p. 451, pl. xx. figs. 1-9 (1912).

*Perigastrella labiata*, Canu & Bassler (Early Tert.), p. 576 (1920).

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\* B. M. P. p. 373, fig. 17.

This is much like the *Mucronella microstoma*, Norman, I described from Santa Margherita \*, in which, however, the marginal pores are much larger, the ovicell is smaller, and there are three oral spines, while *labiata* has four.

The *E. labiata*, Boeck, from Kara Havet, sent by Levinsen, has two kinds of ancestrulæ; the first (Pl. XVIII. fig. 1) is oval, with eleven spines round the border; the second (Pl. XVIII. fig. 2) has eleven spines, five of which are round a somewhat depressed cryptocyst, the aperture has concave proximal margin. The counting of the spines has been difficult on account of extraneous matter. In fact, it is just the same as the ancestrula of *Escharella indivisa*, Lev. (*op. cit.*), as described by Levinsen, except that in Levinsen's species there may be four to six spines surrounding the aperture. In the colonies, with two forms of ancestrula, no difference is seen in the zoecia. *Discopora coccinea*, Abild., as figured by Smitt, has two forms of ancestrula, the one with merely spines round, the other with a calcareous growth in the proximal part of the ancestrular aperture, and is much like the ancestrula of the second *E. labiata*, from Kara Havet. The ancestrula of *labiata* is also described by Andersson (p. 548), as having eleven spines, the second zoecium six, and the third five.

Several cases are now known of species with two forms of ancestrula, as *Microporella malusii*, Aud., *Discopora coccinea*, Sm., *Escharella labiata*, Boeck, *Schizoporella vulgaris*, Moll., of which a second form has been described by Harmer. The modification is not as great as it appears at first sight, and concerns, principally, more calcification in the second form.

It must not, however, be concluded that this is only a further stage of the simple form, for in large mature colonies either form may be found, proving their distinctness.

*E. abyssicola*, Norm., *E. labiata*, Boeck, *E. indivisa*, Lev., *E. microstoma*, Norm., have large zoecia with the central frontal imperforate. Most of the group have a wide lyrula, but *microstoma* has a narrow one. I have fairly large colonies of *E. microstoma* from Santa Margherita, N. Italy, which, when examined from above, show no signs of a lyrula, other pieces examined from below may in some zoecia, not all, show an extremely minute lyrula; other specimens have the lyrula as in my figure. Nordgaard has given figures of the lyrula in six species, but, unless supported

\* (*M. pilosa*), p. 609, pl. xix. fig. 6.

by other characters, too much reliance should not be placed on this alone. Perhaps we shall find that too many species have been created on slight differences.

*Inversiula inversa* (Waters).  
(Pl. XVIII. figs. 3, 5, 6, 7.)

*Porina inversa*, Waters, Ann. & Mag. Nat. Hist. ser. 5, vol. xx. p. 190, pl. iv. fig. 23, pl. v. fig. 5 (1887).

*Microporella inversa*, Waters, *op. cit.* ser. 6, vol. iv. p. 6, pl. i. figs. 11, 12 (1889); Whitelegge, Proc. Linn. Soc. N.S. Wales, ser. 2, vol. ii. p. 680 (1887); Thornely, Australian Antarctic Expedition, "Polyzoa," vol. vi. p. 11 (1824).

*Inversiula inversa*, Levinsen (Morph.), p. 317, pl. xxiii. fig. 11.

In the growing-edge the zoecia have a holocyst, from which grow plain calcareous tubes over the frontal pores, but in the older zoecia this is obscured by further growth; at first there is no trace of "mosaic radiate plates" mentioned by Levinsen, nor are the pores yet stellate, and these "radiate plates" are only visible in a second stage, and also not in the oldest. In the decalcified specimens the frontal pores are in the centre of irregular divisions, which become angular in the completed dry state.

The most interesting thing about the species is that underneath the outer membrane, and above the calcareous frontal, there are, as seen in decalcified specimens, tubes or canals winding in and out round the frontal pores. This I have previously shown in *loc. cit.*, vol. iv. pl. i. fig. 12, though perhaps a more characteristic zoecium might have been found, and now, in Pl. XVIII. figs. 2, 5, 6, it is shown that these canals are really prolongations of the marginal tubes, no doubt joined to the pore-chambers. The marginal tubes in the side-walls of the zoecia descend to the base of the zoecium, and are there joined by a lateral tube to the neighbouring zoecium. There is, of course, great variability in the zoecia, so that a number of figures would be necessary for full illustration.

Many suggestions have been made as to the calcareous external frontal in certain Cheilostomata depending on the areolar tissue, but these canals are not general in the Cheilostomata, though mentioned by Levinsen in *Anarthropora monodon*, but it is not clear whether he fully appreciated the structure when he says "we thus find a system of winding canals, which open outwards through a circle of marginal pores," whereas, judging from the dried specimens examined, these canals are the continuation of the areolar tubes. The



canal is not in line with the radial pores, but is in between them. In this respect it agrees with Harmer's figure of (*Cribrilina philomela* (Morph. pl. xv. fig. 8). Perhaps these two species will help to elucidate one another, and we may hope for more progress when *Microporella* and *Cribrilina* have been carefully compared. Harmer\* says, "The Cribrilinidæ are transitional from *Membranipora* to some at least of the Lepralioid genera."

In a slightly weathered specimen of *inversa*, the grooves on the front, where the canals have been, are very clearly seen, passing between the rows of pores, which are arranged more or less radially, as in *Cribrilina*. They are found to start from the marginal pore and the line of the grooves passes between the radial row of pores (Pl. XVIII. fig. 5). We are able to trace the shell-growth in *inversa*, for, as seen at the growing-edge, at first there is a plain thin calcareous wall, then pores may be formed with a thicker calcareous deposit round them, and presumably through the canals the calcareous matter for the first stage of the wall is carried. At one of the early stages the marginal pore is between two buttresses (left zoecium of "*Cribrilinidæ*," Pl. XVII. fig. 1), thus forming an areola, but later nothing of the kind is seen, only frontal pores distributed over the whole surface. In the centre of one moderate-sized colony are the early zoecia, and in this case the middle one (the ancestrula?) is much raised with three distal zoecia and two proximal (Pl. XVII. fig. 7). Is there an earlier zoecium under the raised one? In other specimens there are fairly similar early growths.

Miss Thornely found *Inversiula* from Commonwealth Bay, 3-5 fath., but says she did not find any avicularia.

### *Schizoporella crustacea* (Smitt).

(Pl. XVIII. figs. 9, 12, 16.)

*Myriozoum crustaceum*, Smitt (Haf.-Bryozoer), 1887, pp. 18 and 114, pl. xxv. figs. 88-91; Robertson, Incr. Chil. Bry. p. 295, pl. xxi. fig. 54 (1908).

*Schizoporella crustacea*, Lorenz, Jan Mayen, pp. (5), 87, pl. vii. fig. 2 (1886); Waters (Franz Josef), p. 64, pl. viii. figs. 11-13 (1900).

For other synonyms, see Miss Jelly's Catalogue.

The best figure and description is that of Lorenz. The zoarium is adnate. The zoecium has very large pores sloping towards the distal end, with an avicularium at each side higher than the oral aperture. At the growing-ends

\* Morph. p. 286.

these pores are very distinct, but they are not so regularly seen in the older zoëcia. There are bars from the side of the zoëcia, but they do not form regular areolar spaces. From the dorsal surface these delicate bars are very clearly seen, and there seems to be a sac between them.

In a colony from Günther Sound there is a second specimen with an ancestrula (visible from below), but it is overgrown by a second layer of zoëcia, as may be seen in (Pl. XVIII. fig. 9), which also shows the first growth of a second layer being formed. It grows upon *Flustra*, and, as this last is transparent, the dorsal growth can be followed in the large ancestrula, which is similar to the one I figured from the same slide\*.

From Smitt, Levisen, to Marcus, *Myrizoum* has been misunderstood. *Myrizoo* was described by Donati in 1750, and the species which he well figured was *M. truncatum*, the species being subsequently named *truncatum* by Pallas, and this must be the type of the genus and of the species, but Smitt under *Myrizoum* says "zoëcia avicularis ad latera duobus muniuntur," though *Myrizoum truncata* has no avicularia—at least out of a large quantity I have never seen one, and none have been described. It is a very large erect branching species with a subtriangular to round operculum, double the size of that of *coarctatum* or *crustacea* (Pl. XVIII. figs. 15, 16).

I gave a figure of the operculum of *M. truncatum* in a paper† which probably few of the present generation have seen, and there I showed that the shape of the oral aperture could best be made out by an examination of the opercula. It has often been thought that I then suggested a classification based upon the opercula—however, the point was how the examination could be facilitated. They have, however, helped much in classification, and much assistance can still be obtained from them. Marcus has given two figures‡ of the operculum of *M. truncatum*, thinking that the one is from a young zoëcium, the other from an older one. This is not the case, but the wider one is from an ovicelligerous zoëcium, the other being from an ordinary zoëcium. Levisen, in spite of the differences, describes *Myrizoidæ* as with a pair of avicularia and also pore-

\* (Franz Josef), pl. viii. fig. 13.

† "The Use of the Operculum in the Determination of the Cheil. Bry.," Proc. Manchester Lit. & Phil. Soc. vol. xviii. pl. i. (1878).

‡ "Swed. Sc. Exped.," K. Svenaka Vetén. Hand. vol. lxi. p. 20, pl. i. figs. 9, 10 (1921).

chamber. In the synopsis *Myrizoum* is credited with a transverse bar to the non-existing avicularium, and a family-character is no pore-chambers. I have considered that *Myrizoum truncatum* stands by itself. Apparently Smitt was not well acquainted with Donati's paper or, perhaps, with the Mediterranean *truncatum*, though he examined a specimen in a Danish Museum and he seems to have taken *M. coarctatum* and *M. subgracile* as the types, so that *truncatum* was really left out of its own genus by both Smitt and Levinsen; and Marcus, *loc. cit.*, when he speaks of my overlooking Levinsen's table, in my paper on "Zanzibar," p. 520, was not aware of the series of mistakes which have been made, and probably was only thinking of Levinsen's synopsis.

In the central growth of a specimen of *S. crustacea* (Pl. XVIII. fig. 9) one zoecium is seen much like the blind zoecia of *Lepralia otto-muelleriana*, and from about this position there are three distal zoecia, and from one a new curved zoecium arises, and we do not know if the ancestrula is below the blind zoecium, nor do we know whether this growth is normal or abnormal, as only one overgrowth has been studied.

I found in *Myrizoum truncatum* 26-27 tentacles, and Pergens says 32. *M. coarctatum* has 16, *S. crustacea* 15.

If *coarctatum* and *subgracile* are placed under *Myrizoum*, it by no means follows that *S. crustacea* should also be placed with them. Although based upon a mistake, it would be awkward to discard the family Myrizoidæ, but certainly the genus *Myrizoum* cannot be retained with only a description which does not include the type. Truly, the avicularia are not always reliable characters, but here they are definitely mentioned by Smitt.

Marcus thinks that my figure of the operculum of *M. occlusum* requires some correction, but I find that my figure exactly represents the operculum of a 'Challenger' specimen.

*Micropora fissurata*, sp. n. (Pl. XVIII. fig. 4.)

I have only seen the two zoecia figured, the ancestrula and the next zoecium, but, although mature zoecia are unknown, it seems advisable to figure it, for we are unacquainted with any of the suborder Anasca having an ancestrula at all resembling this, which looks somewhat like the ancestrula of some *Smittina*, etc.

As will be seen, the ancestrula has four oral spines, and three at the base of the area closed by a calcareous wall. The second zoecium has four oral and four zoecial spines.

To distinguish it, until it is found on any perfect or described species, I suggest *fissurata* as a *pro tem.* name.

*Loc.* Cape Horn.

### *Frontal Wall.*

I have found it very difficult to understand the pleurocyst and what has been said about it, and so give my results with some hesitation, in case I have not understood all points. Canu and Bassler's description of species has been carefully gone through, and specimens in my collection have been compared.

The figures I gave of the growing-end of *Lepralia otto-muelleriana*\*, Moll., seems to represent a most instructive pleurocyst, and here we see, over the holocyst, a growth in rib-like fashion from the areolar region, of which Canu and Bassler say, "the areolæ are only lateral tremopores." Where there is a pleurocyst it commences to grow from each side of the zoecium, whereas a tremocyst usually begins from the proximal end, often terminating in a transverse line, as may be well seen in *Schizoporella divisopora*, Waters (Pl. XVIII. fig. 13), and here at first the tremocyst pore is not stellate, but becomes so later on. The holocyst has also pores which are not stellate (Pl. XVIII. fig. 14) at first, so that there are two very similar layers, each at first with simple pores, subsequently stellate.

The pleurocyst-growth often occurs in small patches throughout the life. In the fully mature *Inversiula inversa*, W., areolæ are not seen, though in an early stage are distinct, see my figure †.

Canu and Bassler, p. 551 (Early Tert.), speaking of the Adeonidæ, say, "in all the other families of the suborder Ascophora the areolar pores communicate directly with the interior itself of the zoecium, but in the Adeonidæ the areolar cavities do so by means of the septules. These cavities serve for the passage and protection of the endocrystal elements, which must secrete and deposit the pleurocyst."

There are marginal pores to some zoecia of *Schizoporella pertusa*, Esper, which has a perforate surface, and there are other cases where there are pores generally over the surface

\* "Cribrillinidæ," pl. xvii. figs. 1, 2.

† Pl. i. fig. 11, left top zoecium, *loc. cit.* (1889).

and also a row of marginal pores. The species which have pores distributed over the whole surface will mostly have a tremocyst, and the question now before us is how far the two growths are sufficiently distinctive, so as to be of use in classification. Undoubtedly, the nature of the frontal wall should be indicated in descriptions, and will, no doubt, help in distinguishing species, but I am not very hopeful for more than a limited assistance in genera and families. Whenever fresh distinguishing characters are found, great hopes are raised of the utility in classification, and then it is often found that they are only specifically of much value, but if they help to show what species are closely allied that will help with larger classifications.

Canu and Bassler, throughout their work, mention which species have a tremocyst and which a pleurocyst, but no pleurocyst seems to be mentioned in the description of the *Anasca*, though they only say very rare in the *Anasca*. It seems to be common in *Smittina* and its allies such as *Mucronella*, *Umbonula*, etc. It occurs in most of the *Lepralia* group, and generally in the Adeonidæ. Most of what we have considered *Schizoporella* have a tremocyst, as also *Porella* and the Stomachosellidæ and *Plagiosmittina*. The thicker and more solid walls usually have a pleurocyst.

With the tremocyst the frontal layer must be formed close round the pores, as is shown by Norman\* for the median lacunæ of *Gephyrotes nitido-punctata*, Sm., and I have shown it † in *Cribilina punctata*, Hass.

The frontal of *Inversiula* is dealt with more fully on page 433.

## EXPLANATION OF THE PLATES.

### PLATE XVII.

- Fig. 1.* *Lepralia pallasiana*, Moll., natural size. A zoarial disk, showing the lines of the vacancies. From Santa Margherita.  
*Fig. 2.* Ditto,  $\times 12$ . Piece showing four vacancies.  
*Fig. 3.* Ditto,  $\times 25$ . A blind zoecium.  
*Fig. 4.* Ditto,  $\times 25$ . A wide zoecium above a vacancy, showing growth from two zoecia not close together.  
*Fig. 5.* Ditto,  $\times 25$ . Growing end of zoarium.  
*Fig. 6.* Ditto,  $\times 12$ . Wide zoecium above a blind zoecium, attached to a zoecium on each side.  
*Fig. 7.* Ditto, natural size. Dorsal surface of small irregular colony.  
*Fig. 8.* Ditto,  $\times 25$ . Dorsal surface showing commencement of growth.  
*Fig. 9.* *Peristomella sauroglossa*, Lev.,  $\times 25$ . Showing two zoecia with

complete ovicells, and one between them with the ovicell broken down and in the lower wall of which delicate tubes pass from the base, really to the areolæ of the ovicell. From Napier, N.Z. (a) Young zoecium with bordering pores,  $\times 25$ .

Fig. 10. *Microporella malusii*, Aud.,  $\times 85$ . Base of ovicell, showing tubes radiating to the border, where they form the ornamental pores.

Fig. 11. *Periatomella sauroglossa*,  $\times 85$ . Operculum.

Fig. 12. *Mucronella coccinea*, Abildg.,  $\times 25$ . Showing ancestrula. From Naples.

## PLATE XVIII.

(1) Fig. 1. *Peristomella labiata*, Boeck,  $\times 25$ . Showing ancestrula in colony. Eleven spines. From Kara Havet.

(1) Fig. 2. Ditto,  $\times 25$ . Showing different form of ancestrula in colony, with lower part having a calcareous wall. From Kara Havet.

Fig. 3. *Inversiula inversa*, Waters,  $\times 25$ . Showing canals under the membrane, but above the calcareous frontal wall. From Sydney.

Fig. 4. *Microporella fissurata*, pro tem.

Fig. 5. *Inversiula inversa*, W. A somewhat weathered specimen, of medium age, showing the pores with the calcareous deposit formed round them, also the grooves formed for the canals and the bordering pores, from which the canals commence.

Fig. 6. Ditto. Dorsal surface showing base of pore-chambers.

Fig. 7. Ditto,  $\times 25$ . Ancestrula.

Fig. 8. *Lepralia otto-muelleriana*, Moll. Ancestrula etc. from a fair-sized colony.

Fig. 9. *Schizoporella crustacea*, Sm.,  $\times 25$ . Central zoecia from colony. From Günther Sound.

(1) Fig. 10. *Lepralia eliminata*, Waters,  $\times 25$ . Ancestrula centre of large colony. From Green Point, Port Jackson, N.S.W.

Fig. 11. *Lepralia pallasiana*, Moll. Showing growing-edge with pores round the border.

Fig. 12. *Schizoporella crustacea*, Sm.,  $\times 25$ . Growing-edge.

Fig. 13. *Schizoporella divisopora*, Waters,  $\times 25$ . Showing second calcareous layer terminating transversely.

Fig. 14. Ditto,  $\times 25$ . Near growing-edge, first layer with simple pores.

Fig. 15. *Myriozoum truncatum*, Pallas,  $\times 85$ . Operculum.

Fig. 16. *Schizoporella crustacea*, Sm.,  $\times 85$ . Operculum.

LIX.—Notes on the Rangoon Earthworms. *The Peregrine Species.* By G. E. GATES, Judson College, Rangoon, Burma.

Rosa, Stephenson, and Gates have described fourteen specimens of earthworms from Rangoon. These are:—

- Drawida gracilis.*
- *longatria.*
- *peguana.*
- *rangoonensis.*
- *rara.*

- Pheretima anomala.*
- *insolita.*
- *planata.*
- *peguana.*
- Perionyx excavatus.*
- Octochætus birmanicus.*
- Eutyphæus foveatus.*
- *peguanus.*
- *rarus.*

This list does not accurately represent the earthworm fauna of this city. It merely includes those species which have not been hitherto recorded from regions outside of Burma, and which may for the present at least be regarded as being endemic in Burma, plus three species which have been reported from outside of Burma—these last are *P. anomala*, *P. peguana*, and *P. excavatus*. It is therefore desirable to record the remaining eight peregrine species, some of which are very common all the year round and which constitute an important part of the local Oligochaete fauna. In addition, there are included in this paper descriptions of abnormalities, of variations of various structures, as well as descriptions of certain differences of the local forms from previous accounts. This concludes a series of papers in this Journal on "The Earthworms of Rangoon." The writer wishes to take this opportunity to express his gratitude to Lt.-Col. J. Stephenson, I.M.S., Lecturer in Zoology in Edinburgh University, for advice and assistance so generously given in various ways in connection with this work.

*Megascolex mauritii* (Kinb.).

*External Characteristics.* — Length 95–155 mm., diameter 3–4 mm. Number of segments 160–190. The worms are greyish in colour (formalin preservation) and only slightly darker on the dorsal than on the ventral side. The clitellum is just a trifle greyer than the rest of the worm or of a brick-red colour.

The prostomium is usually prolobous, rarely combined pro- and epilobous.

Secondary furrows are, as a rule, not present, but if present there are usually two, one anterior to and the other posterior to the setal circles.

The first dorsal pore is in 10/11 or 11/12, and is much smaller than the succeeding pore in 11/12 or 12/13.

The setæ begin on ii. Behind the clitellum there is a wide ventral break, *aa* being equal to 2–4*ab*. A dorsal break is not usually present, but if it does occur *zz* varies from 1½–2*yz*. Setæ *a*, *b*, *c*, and *d* are slightly enlarged, the setæ and the setal intervals decreasing regularly in size from *a* or *ab* outwards. On segment *xx* there may be thirty or forty setæ, but the number is usually between thirty-three and thirty-seven.

The clitellum begins just behind the setæ of *xiii*. in about

20 per cent. of the specimens and at the intersegmental furrow 18/14 in the remainder, extending in all cases to 17/18 (4-4½). Setae are present and rarely dorsal pores.

The spermathecal apertures are located in 6/7, 7/8, and 8/9, and are in line with seta *h*.

The female pores are minute slit-shaped apertures at the centre of a small, circular, light-coloured area on segment xiv., lying in the setal interval *aa* just anterior to the setal circle.

The male pores are minute apertures in the setal circle of xviii.

The ventral body-wall around the male pore is swollen on each side, pushing forward or backward the intersegmental furrows in their immediate vicinity. This swollen area extends from just internal to seta *a* nearly to seta *d*, and is crossed by two transverse secondary furrows which divide the area into three parts. In the centre of the middle part is the minute male pore. The anterior and posterior thirds are, owing to the displacement of the intersegmental furrows, wider than the middle region. At the centre of the swelling the secondary furrows often widen slightly and deepen into crescent-shaped depressions within the outer third of the genital area. These genital markings, roughly speaking, have an eye-like appearance. In worms in which the swelling is particularly prominent there is usually a longitudinal furrow connecting intersegmental furrows 17/18 and 18/19, which sharply delimits the swollen area on the outer side. A second short furrow less often marks off the inner border of the area. This outer longitudinal furrow frequently produces the trilobate appearance described and figured by Stephenson as characteristic of *M. trilobata*. In a few specimens the top of the swollen area is flat. Occasionally the penial seta may be seen projecting through the male pore.

*Internal Anatomy.*—Septum 4/5 and succeeding septa are present; 5/6 is thin and transparent and easily overlooked. It is attached to the posterior part of the gizzard in such a way that the latter part of that organ appears to be in segment vi. It is, however, fairly easy in well-preserved specimens to push back the septum from the gizzard without tearing. In poorly preserved specimens it is difficult to find this septum. Septa 6/7-12/13 are slightly thickened, and 13/14 and 14/15 are very slightly thickened.

The gizzard is in segment v. in all specimens. The interior wall of the oesophagus in segments xi. and xii. has thick-set longitudinal ridges.

The last pair of hearts is in segment xiii.

The testes and funnels are paired and free in segments x. and xi. Paired seminal vesicles, much cut up into fine lobes and varying in size (they may be minute, or large enough to meet dorsally over the dorsal blood-vessel), are present in segment xii. About half of the worms have a similar but slightly smaller pair of seminal vesicles in segment ix. The prostates are fairly large, much lobed, confined to segment xviii., but stretching septa 17/18 and 18/19



out of their normal positions. The prostatic duct is straight, 1 to 2 mm. long; immediately dorsal to it is the sac containing the penial setae.

The oviduct-funnels are small and in the usual position. The ordinary leaf-like mass of ova on the posterior face of 12/13 on each side is lacking. In its place there are on each side of the segment numerous "strings" of eggs, attached anteriorly to 12/18 and posteriorly to 13/14. The condition resembles that described by Leigh-Sharpe from one side of a specimen of *Helodrilus longus*, except that in the present specimens there is no "reservoir" of ova at the anterior end of the segment from which the "strings" pass to the posterior septum. As it seemed possible that this condition might be abnormal, this segment was examined in numbers of specimens picked at random from the collections, but the condition was the same in all.

There are small paired ovisacs, filled with ova, in xiv. on the posterior face of 13/14, high up on the septum, lateral to the alimentary canal, in about half the specimens. In others there are small sacs which contain no ova, while in yet others the sacs appear to be entirely lacking.

The spermathecal ampulla is very long and variously doubled on itself. The duct is short, stout, barrel-shaped, nearly as wide as the ampulla, one-quarter to one-third as long, or even less. It is filled with a densely-packed substance which projects as a cone into the ampulla and which has a faint pearly appearance. Two minute finger-shaped diverticula, two-thirds to three-quarters as long as the duct, are attached, one on each side, to the duct close to the body-wall.

The penial setae are 1.8–1.6 mm. long, 45–60  $\mu$  wide at the base, 30  $\mu$  at the middle of the shaft, and 35–45  $\mu$  in the region of the greatest number of teeth. The shaft is gently curved and the free tip may be bent at a rather sharp angle. The tip is scoop-shaped; about 30–40  $\mu$  from the distal end is a zone of 120–130  $\mu$  in length which is densely covered with triangular teeth with the tips pointing distally; the following 60–90  $\mu$  of the shaft may have similar but smaller teeth more sparsely scattered. The web between the two prongs at the tip, which makes the scoop, varies in size, so that sometimes there hardly seems to be any web at all between the prongs, while at others, it extends clear to the tip of the prongs. In the majority of cases the distal end of the web lies between these two extremes. In some specimens the teeth are less triangular and more spine-like.

*Occurrence.*—All the year round.

*Remarks.*—It might be thought from the frequent occurrence of two conditions of the various organs in the account above—such as grey or red clitellum, trilobate or non-trilobate appearance of the genital areas, presence or absence of the seminal vesicles in ix., presence or absence of ovisacs in xiv.—that two distinct varieties were present in the collections examined. It has not been possible to separate out two varieties, as these characteristics are

not grouped together in definite combinations, but apparently only in fortuitous arrangements. Some of the differences—as, for instance, the presence or absence of the ovisacs—may be due to seasonal variations. The specimens examined were collected at different times during the year.

Stephenson has described from India, under the name *M. trilobata*, a worm which differs from *M. mauritii* in possession of a “web connecting the limbs of the terminal horseshoe of the penial setæ, as just mentioned, the broad flat characteristically shaped papillæ on segment xviii., the gizzard in segment v., and the presence of only one pair of seminal vesicles.” The Rangoon specimens have a web between the prongs of the penial setæ, the gizzard in segment v., may lack the anterior pair of seminal vesicles, and may have the flat trilobate appearance of the genital areas. But the penial setæ are not like the figure given by Stephenson in his original description of *M. trilobata*. Although the local specimens may have some of the characteristics which distinguish *M. trilobata* from *M. mauritii*, it is not possible to separate out specimens having these characteristics as a separate species or even as a separate variety. Stephenson, discussing at a later time further specimens of *M. trilobata* received from Bombay, says, “The discs on segment xviii. on which the male pores are situated are not here distinctly trilobed on their outer edge (a character from which the species was named),” and gives a second figure of the penial setæ which closely resembles the setæ of the local forms\*.

The original and later descriptions of *M. mauritii* are not available in this province, so that it has been necessary to rely entirely upon the account given by Stephenson in the ‘Fauna’ volume. Through the kindness of Dr. Prashad of the Zoological Survey of India and Miss Shivers of Judson College, it has been possible to examine specimens of *M. mauritii* from the collections of the Indian Museum. In these specimens the male areas correspond closely in appearance to those of the local forms, the gizzard is in segment v. in all cases. The anterior seminal vesicles are lacking in one worm, present in the others. The spermathecae and the penial setæ are the same as these organs in the local forms, but there are no ovisacs in any of the Museum specimens. In response to a request from the writer, Prof. Bahl of the University of Lucknow very kindly sent two specimens of *M. trilobata*, which he stated were obtained at Benares. Both have the characteristic appearance of the male area as described and figured by Stephenson for the species. One specimen has paired seminal vesicles in xi., the other has not. The gizzards in both are in v. The penial setæ are the same as those of the Rangoon and Museum forms (locality unknown), but there are no ovisacs.

The only important difference of the local from the Museum forms is the presence of the ovisacs in the majority of the Rangoon

\* No figure of penial setæ of *M. mauritii* is available locally.

worms. Aside from this and the more anterior development of the clitellum, and allowing for individual variations, especially in the appearance of the genital markings, the Rangoon specimens must be considered the same as the Museum specimens. The trilobate appearance of the male areas seems to be only an expression of physiological difference, perhaps due to unusual contraction in the killing fluid. In view of these facts, *M. trilobata* would appear to be a synonym of *mauritii*.

*Description of an Abnormal Specimen.*

*External Characteristics.*—Length 92 mm., diameter 3 mm. The clitellum begins on the right side at 13/14 and extends to 17/18, and on the left side extends from 12/13 to 16/17. The transition between the clitellar and the non-clitellar parts of segments xiii. and xvii. is gradual and not abruptly marked. The spermathecal pores are as usual, except that the last pore on the left side is lacking. There is a single female pore in the setal circle of xiii. and a similar pore in the setal circle of xiv. The male area of the right side is on segment xviii. and that of the left side on segment xvii.

*Internal Characteristics.*—The gizzard is in segment v. The last spermatheca on the left side is lacking. There are testes and male funnels on both sides of segments ix. and x. There is a funnel on the right side in segment xi. and a small seminal vesicle on the left side attached to the posterior face of 10/11. In segment xii. there is a small seminal vesicle on the right side attached to the posterior face of 11/12, and on the left side an ovary and oviduct funnel attached to the septa in the usual places. In segment xiii. there is an ovary and oviduct funnel on the right side only. The ova are in "strings" as described for the other Rangoon specimens. The prostate of the right side is in xviii. and that of the left side is in xvii.

*Pheretima elongata* (E. Perr.).

*External Characteristics.*—Length 160–220 mm., diameter 4–5 mm. Number of segments 169–241. Unpigmented, formalin specimens greyish. The prostomium is prolobous.

There are two deep secondary furrows, one anterior to, and the other posterior to, the setal circle, on each of segments iv.–xiii. The number of slighter tertiary furrows varies, in one specimen it is as follows:—on each side of segments viii.–ix. the most posterior and anterior annuli formed by the secondary furrows are subdivided by slighter furrows; on xii. there are eight slight furrows, and on xiii. there are five slight furrows. Some of these slight furrows may not form complete rings all around the segment.

The first dorsal pore is in 12/18 and is much smaller than the next pore in 13/14.

The setæ begin on segment ii. Dorsally and laterally the setæ are small and close together and project only very slightly from the surface. There may or may not be a very slight break in the setal circle dorsally. If the dorsal break is present  $zz$  equals  $1\frac{1}{2}$ – $1\frac{1}{4}yz$ . Anterior to the clitellum, except on segments ii.–v., there are four large ventral setæ projecting conspicuously; and  $aa$  is greater than  $ab$ , which is greater than  $bc$ . Setæ  $a$  and  $b$  are not appreciably enlarged on ii. and iii. and only slightly on iv. There is no ventral break on ii. and iii. Posterior to the clitellum setæ  $aa$  are enlarged and widely separated,  $aa$  being equal to 2–4 $ab$ . Seta  $b$  may be slightly enlarged, in which case  $ab$  is greater than  $bc$ .

The clitellum is ring-shaped, on segments xiv.–xvi. (=3). Dorsal pores and intersegmental furrows are lacking, but setæ may be present ventrally on segments xiv. and xvi.

The male pores are on xviii., each at the top of a conical papilla. Between the two papillæ twelve to sixteen setæ intervene. At the outer side of the papilla and extending around only very slightly on to the anterior and posterior faces is a much wrinkled lip with a slit-like cavity between the lip and the papilla.

The female pore is single on xiv., at the centre of a small circular lighter-coloured area, in line with the setæ of the segment.

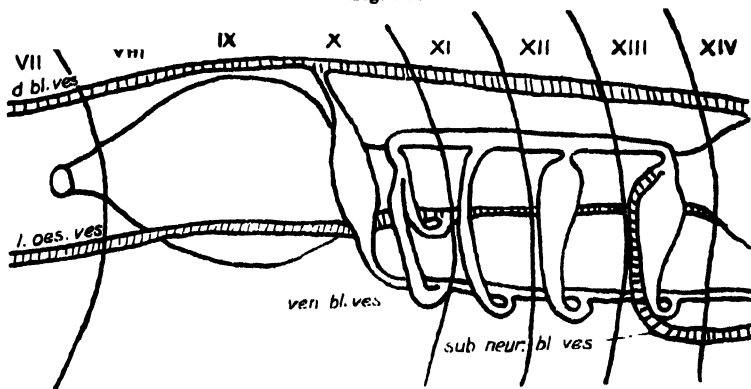
The spermathecal pores may or may not be present, and when present vary in position and number. As the arrangement of these pores is different in all the fully mature specimens of the Rangoon collections they are listed below:—

1. Only one pore present, which is just anterior to seta  $g$  on the left side of segment vi.
2. Only two pores present, both on the left side, each in line with seta  $g$ , in furrows 6/7 and 7/8.
3. There are two pores on the left side only, one in 5/6 and one in 6/7, both in line with seta  $g$ .
4. This worm has three pores, all in 6/7. On the right side there is a single pore in line with seta  $h$ , while the other two are on the left side in line with seta  $h$  and  $j$ .
5. This worm has four pores, all on the right side and dorsal to the lateral line. One pore is located on the posterior part of segment v. close to 5/6, the other three are close together on the posterior part of vi. near 6/7.
6. Four pores are present. On the right side there is one in 5/6 in line with seta  $g$ , and two in 6/7 in line with setæ  $g$  and  $i$ . On the left side there is one pore in 6/7 in line with seta  $j$ .
7. The spermathecal pores are paired and located in 5/6 and 6/7, those of a pair about one-quarter of the circumference apart.
8. There are six pores, five in 6/7 of which three are on the left side in line with setæ  $g$ ,  $i$ , and  $k$ , and two on the right side in line with setæ  $h$  and  $j$ , and one pore in 5/6 on the right side in line with seta  $h$ .

All other specimens either have no spermathecal pores or are immature. The presence of spermathecae as indicated by the pores has been confirmed in each case by dissection.

The genital markings are paired oval areas on segments xix.-xxiii. Each marking is a transverse oval area beginning in line with seta *d* and extending outwards, so that the outer border is in line with the outer border of the male porophore. The marking belongs to the anterior part of the segment, lying between the intersegmental furrow in front and the setal circle, although frequently the setae are included in the posterior border of the area. The body-wall in the region of these areas is swollen, so that the genital areas are in contact with each other antero-posteriorly and appear to involve the whole segment. The anterior part of the swelling can be pushed back from the posterior part of

Fig. 1 a.

*Pheretima elongata* (E. Perr.).

Lateral view of commissures.

the segment in front. A slight swollen ridge may extend from the oval area of one side to the area on the other side, just anterior to the setae. At the centre of each of these oval markings is a circular greyish area which sometimes projects slightly from the surface.

*Internal Anatomy.*—Septa 5/6, 6/7, and 7/8 are thickened, the latter especially so; 8/9 and 9/10 are missing; 10/11 is dislocated backwards and attached to the parietes at the level of the intersegmental furrow 11/12; 11/12 is attached at the level of the setae of xii.; 12/13 is attached at the level of the setae of xiii.; 13/14 is attached slightly posterior to the level of furrow 13/14. Septa 10/11 to 13/14 are funnel-shaped.

The gizzard is small with an enlarged posterior rim, urn-shaped. The intestine begins in xv. There are no intestinal caeca, but the

alimentary canal is sacculated for six to eight segments beginning in segments xx. or xxi. The walls of the sac are pushed so far into the lumen that those of opposite sides meet in the centre. The typhlosole is medium-sized and begins in segment xvi. or xvii. There is a longitudinal subœsophageal sheet of tissue attached ventro-laterally to the œsophagus, which extends from just behind the ventral junction of the first pair of commissures in the combined gizzard-segment through segment xiii., sometimes through segment xiv.

There are large nephridial masses in v. and vi. dorso-lateral to the alimentary canal.

There are no conspicuous blood-glands in v. or vi. or lymph-glands posteriorly.

The vascular system of the present specimens (fig. 1 *a*) differs in a number of details from that of the other Rangoon species of this genus. On opening the worm from the dorsal side only three pairs of commissures are visible, one pair just posterior to the gizzard and the last two pairs which are large and in segments xii. and xiii. Between the last two pairs and the anterior pair are two more pairs of commissures concealed in the testis-sacs and visible only after the membrane has been dissected off. There are no conspicuous vessels passing from the dorsal blood-vessel to the gizzard, and the first pair of commissures posterior to the septum 7/8 is in contact with the posterior rim of the gizzard. These commissures unite ventrally underneath the alimentary canal to form the ventral blood-vessel, which is not continued in these specimens anterior to this junction. The next pair of commissures lies within the testis-sacs belonging to segment x. These arise dorsally as a branching and diverging of the supra-œsophageal vessel, which is not continued anterior to this divergence, at least as a vessel visible on the dorsal surface of the alimentary canal. Just as each of these commissures turns downward in the testis-sac in which it lies, it divides into two branches which lie for a time against each other. The smaller posterior branch opens into the lateral œsophageal of its side, which is much enlarged henceforward. Posterior to the junction of these two vessels the lateral œsophageal receives blood-vessels from the ventral side of the gizzard. The larger anterior part of the commissure gives off a conspicuous branch to septum 10/11, which passes to the lateral and ventral parietes, and then into the ventral vessel as its second commissure of the side. The next pair of commissures is located in segment xi. in the testis-sacs of the segment, and passes from the supra-œsophageal vessel to the ventral vessel. The next two pairs of commissures, those of xii. and xiii., are usually much larger than the others, and likewise connect the supra-œsophageal and ventral vessels. The lateral œsophageals lie on the ventral side of the œsophagus, to which they are intimately attached, and within the subœsophageal chamber.

These vessels are small behind the combined gizzard-segment, and usually cannot be traced further than segment xiii. or xiv.

In one specimen these vessels are full of blood and distended, so that they are easily traceable. In this worm they leave the alimentary canal in segment xv. passing out on to septum 15/16 on each side, through the septum, segment xvi., and through 16/17 into xvii., where they pass into the subneural vessel. The subneural vessel turns to the right side in segment xiii., and passes out from under the nerve-cord and upwards. After giving off conspicuous vessels to the anterior face of 13/14 and to the ventral and lateral parietes, it opens into the commissure of xiii. just above a sharp constriction on the latter.

The dorsal vessel is much longer than the length of the segments in v. and vi., and hence lies coiled on the œsophagus.

The testis-sacs of x. are large and suspended on the anterior

Fig. 1 b.

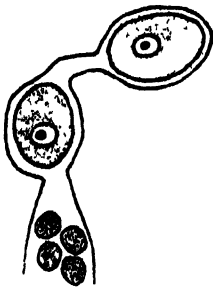
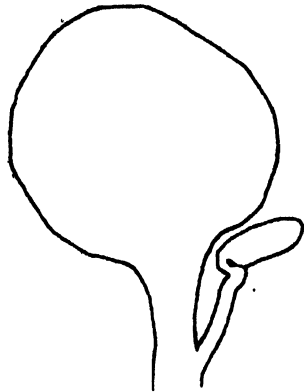


Fig. 2.



*Pheretima elongata* (E. Perr.).

Fig. 1 b.—Egg "string."  $\times$  ca. 110.

Fig. 2.—Spermatheca.  $\times$  ca. 20.

face of 10/11. Dorsally they are attached to the sides of the dorsal blood-vessel, but are not fused over it. The testis-sacs of xi. are also large, but not fused dorsally. They contain the small pair of seminal vesicles of the segment. There is a pair of small seminal vesicles in xii. which do not meet dorsally. In xiii. on the posterior face of 12/13 is a pair of small ovoid vesicles which may possibly be ovisacs, although they contain no ova.

The prostates are in segments xvii.—xix. and are much lobed. The duct is in xviii., it passes from the edge of the gland towards the nerve-cord, turns slightly forward, and then turns enlarging rapidly, and passes back along the narrower portion until at the edge of the prostate it passes downwards into the body-wall.

The ovaries are in the usual position. They are composed of small, closely packed bodies, the nucleus of which is proportionately very large, especially so in the smallest of the bodies. At the outer free fringes of the ovary are loose "stringy" projections, each of which contains a very much larger ovum (rarely two) (fig. 1*b*). The number of these mature ova is usually small, in the present specimens between twenty and thirty in each ovary.

The appearance of the spermathecae (fig. 2) is about the same in all the segments and various positions. The ampulla is heart-shaped or ovoid to spherical, and nearly twice as long as the duct. The diverticulum is slightly longer than the duct, and arises from the anterior face or the inner side of the duct near the base. It is slightly enlarged along the ental third or half of its length.

Corresponding to the position of the genital markings are flat, softish, sessile glands.

*Distribution.*—Rangoon. This species has not been previously reported from Burma, although it is widely scattered through India.

*Occurrence.*—This species seems to be very rare in Rangoon, and, although careful search has been made for the worm in the localities from which it has been secured, only seventeen specimens have been found—eleven in June 1924, four in November 1924, and two in January 1923.

*Remarks.*—The Rangoon specimens differ in the following points from the description given in the 'Fauna' volume:—

1. The last pair of hearts is in xiii. instead of xii.
2. The testis-sacs are not fused dorsally over the dorsal blood-vessel.
3. Septa 8/9 and 9/10 are absent. (There is no mention of these septa in the 'Fauna' account.)

Bahl has described the blood vascular system of *Pheretima* from peregrine species found in the Kew Gardens, England, and at Lahore as typical of the genus. The vascular system of the present specimens differs from that account as follows:—

1. The ventral vessel does not continue anterior to the gizzard-segments, but comes to an end with the first pair of commissures behind the gizzard.
2. The subneural vessel does not bifurcate and pass up on to the alimentary canal to become the lateral œsophageals, but passes into the right commissure of segment xiii.
3. There are no heart-like commissures from the dorsal blood-vessel to the gizzard.
4. The commissures of xi. pass from the supra-œsophageal vessel into the ventral vessel instead of the lateral œsophageal.
5. The second pair of commissures behind the gizzard is double, and connects both the lateral œsophageal and the ventral vessels with the supra-œsophageals.



If the description of the vascular system given by Bahl is typical for the genus, the soundest interpretation of the conditions of the vascular commissures in this species seems to be that the heart-like commissures belonging to viii., instead of passing to the gizzard, have continued on to the ventral vessel. The dorsal parts of the commissures of ix. have then become attached to the upper parts of the commissures of x. instead of to the dorsal blood-vessel.

In a previous paper it has been pointed out that the condition of certain vessels, especially the commissures of x. and xi., varies in almost all of the Rangoon species of this genus from the description given by Bahl. The genus is a large one, and this system has not been studied in the vast majority of the species. Bahl's work was done on peregrine forms, which may be expected from their unusual powers of migration and adaptation to have certain modifications from the condition typical for the genus. In view of these facts and the variations already pointed out in the Rangoon species, it is rather early to suggest that the condition of the vascular commissures of these segments in any of the worms in which it has been investigated is typical of the genus.

*Pheretima houlleti* (E. Perr.).

There are three worms in Rangoon which, under certain conditions, can be referred to this species. These three forms do not grade into each other, and the differences between them are constant. One of these forms is described as the typical, and the other two as new varieties. This classification is only tentative. It is hoped to have the opportunity in the near future of examining authentic museum-specimens of this species. Such an examination should clear up some of the difficulties involved.

*Forma typica* (?).

*External Characteristics.*—Length 55–110 mm., diameter 4–4½ mm. Number of segments 92–116. Colour brownish dorsally, except anterior to the clitellum where the segments are usually bluish or slaty grey, and in the region of the mid-dorsal line which is often slightly bluish. The bluish colour often extends over the ventral parts of segments i. and ii. Ventrally whitish. Clitellum reddish or brownish.

The prostomium is epilobous, but the tongue on segment i. is not usually marked off by a posterior transverse furrow.

No secondary annulations have been observed.

The first dorsal pore with but a single exception occurs in 9/10, in the exceptional specimen it occurs in 8/9.

The setæ begin on segment ii. Both dorsal and ventral setæ may or may not be regularly placed on segments ii.–ix. In the latter case the setæ gradually become more closely and regularly placed from segments vii.–ix., but without dorsal or ventral break until segment x., from where onwards both a dorsal and ventral

break are present. Posterior to the clitellum *aa* is equal to  $1\frac{1}{2}$ -*2ab*; the dorsal break is slight, *zz* being only slightly greater than *yz*. The numbers are v./28-29, ix./51-53, xii./50-52, xix./53-56. Some of the ventral setæ on segments ii.-ix. and seta *a* on each side on the succeeding segments are enlarged, conspicuously projecting, straight instead of sigmoid, and ornamented with short transverse ridges of spines. Short thorn-shaped or spine-shaped setæ are also present. Towards the posterior end setæ *a* on each side becomes more and more sigmoid in shape.

The clitellum is ring-shaped, and complete, extending from 13/14 to 16/17 (=8) in all cases. The intersegmental furrows are not visible. The dorsal pores appear to be present, but no colomic fluid can be forced out through the parietes in the region where they are indicated without breaking the body-wall. Setal circles are present and complete on all the clitellar segments.

The spermathecal pores are three pairs in 6/7, 7/8, and 8/9, nearly one-half of the circumference apart, at the lateral edge of the blue-coloured area. The borders of the segments are slightly swollen in the immediate vicinity of the pores. There are no accessory papillæ or other openings near the spermathecal pores. Between the lines of the spermathecal pores there are the following numbers of setæ:—on vi. 12-14, on vii. 14-16, on viii. 23-25, on ix. 24-26.

The female pore is in the setal circle of xiv.

On segment xviii. in the setal circle are the apertures of the copulatory chambers. The body-wall around the apertures is swollen, the swelling on each side extending to intersegmental furrows 17/18 and 18/19, pushing the furrows slightly forwards and backwards. The apertures are surrounded by an indistinctly limited ring of much wrinkled tissue. The pigmentation extends only to the outer edge of this ring of tissue laterally and not down into the concavity. The aperture leads through a narrowed neck into the copulatory chamber, which is occasionally found everted as a porophore. When this occurs, the aperture is, of course, obliterated. Between the apertures are eight to eleven setæ, the number usually being eight or ten.

*Internal Anatomy.*—Septa 4/5, 5/6, 6/7, and 7/8 are slightly thickened; 8/9 and 9/10 are absent; 10/11, 11/12, 12/13, and sometimes 13/14, are slightly thicker than the septa following.

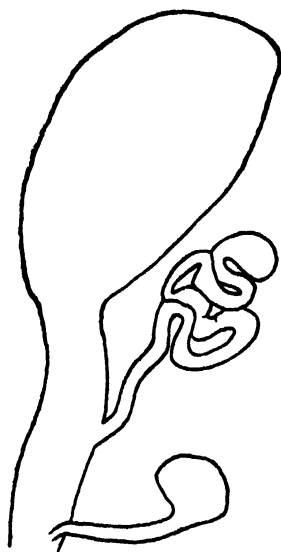
The gizzard is elongate, often with a posteriorly enlarged rim. The intestinal cæca extend from xxvii. to xxiv. The typhlosole begins in the region of segments xxiv.-xxvii., and extends to within 20-30 mm. from the posterior end of the animal.

There are white masses of acinous blood-glands in segments v. and vi. Paired lymph-glands, rather large in size, are found from segment xv. posteriorly.

There are large nephridial masses in segments v. and vi. dorso-lateral to the alimentary canal.

The last pair of hearts is in xiii. In the combined gizzard-segment there are three pairs of vessels:—1, the anterior pair

Fig. 3.



*Pheretima houletti* (E. Perr.), forma *typica* (P).  
Spermatheca.  $\times$  ca. 20.

Fig. 4 a



Fig. 4 b.



Fig. 5.



*Pheretima houletti* (E. Perr.), forma *typica* (P).

Fig. 4 a.—Clitellar seta, bifid tip.  $\times$  ca. 340.

Fig. 4 b.—Clitellar seta with unmodified tip.  $\times$  ca. 300.

Fig. 5.—Clitellar seta with trifid tip.  $\times$  ca. 525.

belonging to segment viii. passing from the dorsal vessel to the gizzard; 2, the middle pair belonging to ix., one of which is usually rudimentary or lacking, from the dorsal vessel to the ventral vessel; and 3, the last pair belonging to x., passing from the supra-oesophageal vessel to the ventral vessel. The commissures of xi. also pass to the ventral vessel, as do those of xii. and xiii.

There is a longitudinal sub-oesophageal sheet of tissue in segments xi.-xiv., as previously described for *P. peguana*.

The anterior testis-sacs are flattened against 10/11 with no apparent communication between the two sacs. The posterior sacs are conical and continued forward to the posterior face of 10/11, to which they are attached just above the place of emergence of the first pair of sperm-ducts. The sperm-ducts come together in segment xii. and unite. They lie loosely on the ventral parietes and are easily traced. The paired seminal vesicles in xi. and xii. are large, lobed, and in contact dorsally with the dorsal blood-vessel.

The prostates are large, lobed, and lie in segments xvi.-xxi. The duct is about  $2\frac{1}{2}$ -3 mm. long and is coiled into two or three loops, which vary so much from specimen to specimen as to be hardly worth describing. The duct passes into the wall of the copulatory chamber on the side away from the nerve-cord (outer face). Behind the copulatory chamber and concealed under septum 18/19 is a small gland or two with ducts running forward to the posterior wall of the chamber. Under septum 17/18 there are also four to eight similar glands with ducts running back to the anterior wall of the chamber.

The copulatory chamber can be dissected off from the parietes, slit open on one side, and turned inside out. On the walls of the chamber there are two or three large papillæ, although the size is not constant. There are no setæ embedded in the walls of this chamber.

The ovaries and oviduct-funnels are in the usual positions.

The spermathecal duct is nearly as long as the flattened ampulla. A single accessory gland accompanies each spermatheca, the stalk of the gland passing into the duct of the spermatheca below the attachment of the diverticulum. The diverticulum is long, and the greater part is coiled into a pyramidal mass (fig. 3).

The clitellar setæ are usually bifid (fig. 4) or trifid (fig. 5), the bifid type being three or four times as common as the trifid. These are 0.1-0.15 mm. long. Very rarely setæ (fig. 4*b*) with the unmodified tip occur. These are of two sizes, the smaller 0.18-0.2 mm. long and the other about 0.4 mm. long.

*Occurrence*.—This worm is found in Rangoon nearly all the year round.

*Remarks*.—This worm differs from the account in the 'Fauna' volume in the following particulars:—

1. Constant small size.
2. Constant position of the first dorsal pore in 9/10.

3. Presence of complete setal circles on the clitellum.
4. Presence of larger setæ with unmodified tip on the clitellum.
5. Presence of glands opening into the copulatory chamber.
6. Absence of functional dorsal pores on the clitellum.

None of these differences are enough to justify separating this form as a separate species. It is evidently a variety of *P. houlletii*. The question then arises, Is this the typical variety or, perhaps, a smaller variety?

Perrier's account is not sufficiently detailed to permit an accurate answer to this question. Possibly two clues to a solution of the difficulty may be obtained from his description. The first is the length, which in the Paris Museum specimens was about 100 mm., which comes within the limits of the present variety. The second is the character of the spermathecal diverticulum, of which Perrier gives two figures. In the first figure (58) the diverticulum appears to be looped backwards and forwards in one plane in a manner to which Rosa has applied the term "zigzag." This type of looping, however, characterizes one of the varieties to be described subsequently and not the present form. In the second figure (59) the loops do not seem to be coiled in one plane in this manner, and are more like the condition in the Rangoon variety. Possibly Perrier had more than one variety of this worm in his collections. (The attachment of the accessory gland and the spermathecal diverticulum to the duct are different in both of Perrier's figures from the condition in the local form.) In view of these facts it seems best to consider the Rangoon worm for the time being as the typical form, indicating the tentativeness of the classification by a question mark.

*Var. tortuosa* (?), nov.

*External Characteristics.*—Length 130–180 mm., diameter 4–6 mm. Number of segments 114–136. Colour dorsally bluish or slaty grey, ventrally whitish. Clitellum reddish to brownish.

The prostomium is combined pro- and epilobous.

There are no conspicuous secondary annulations on most of the specimens examined. There may be, however, on a few segments anterior to the clitellum one or two secondary furrows, either in front of or behind the setal circle or both.

The first dorsal pore is in 11, 12 in every case.

The setæ begin on ii. Both dorsal and ventral setæ on segments ii.–viii. are widely separated and irregularly spaced. The ventral setæ project conspicuously on these segments. Beginning with segment vii., viii., or ix. the setæ become smaller, project less conspicuously, and are regularly arranged and more closely spaced. A ventral break is usually lacking on segments vii.–xii., although there is often a slight dorsal break. Posterior to the clitellum *aa* is equal to *ab* or only very slightly greater than *ab*. The dorsal

break is usually present, but *zz* varies from  $1\frac{1}{2}$ – $3\frac{1}{2}$ . The numbers of setæ are v./24–26, ix./44–46, xii./44–46, xix./53–56. Some of the ventral setæ on segments ii.–ix. are enlarged, conspicuously projecting, straight instead of sigmoid, and ornamented with short transverse ridges of spines. The setæ at the centre of the ventral side of these segments are the largest. Passing from the centre outwardly the setæ become thinner and more and more sigmoid in shape, and the ornamentation gradually disappears. Passing posteriorly from vi. or vii. the same development takes place, the ventral setæ of viii. and ix. being mostly enlarged and ornamented sigmoid setæ. Behind the clitellum seta *a* is not enlarged.

The clitellum is ring-shaped and complete, extending from 13/14 to 16/17 in all cases. Intersegmental furrows and dorsal pores are not visible. Setal circles are present and complete on all the clitellar segments.

The spermathecal pores are three pairs in furrows 6/7, 7/8, and 8/9, nearly one-half of the circumference apart, at the lateral edge of the pigmented area. The borders of the segments are slightly swollen in the immediate vicinity of the pores. In the furrows between segments vii. and viii. and viii. and ix., concealed by the swollen regions of the parietes, and internal to the spermathecal pores, may be one, two, or three minute papillæ indicating the openings of the accessory spermathecal glands. None of these papillæ have been found in 6/7. Between the lines of the spermathecal pores are the following numbers of setæ: on vi. 11–13, on vii. 12–14, on viii. 17–19, on ix. 19–21.

The single female pore is in the setal circle of xiv.

On segment xviii. in the setal circle are the apertures of the copulatory chambers. The parietes around the aperture is not swollen, nor is there any distinct lip. The pigmentation extends ventrally farther on this segment than on the other segments, usually down into the concavity of the copulatory chamber aperture. The aperture leads through a much narrowed neck into the copulatory chamber, which is rarely found everted as a porophore. Between the apertures are 14–17 setæ.

*Internal Anatomy.*—Septum 4/5 is present and thin; 5/6, 6/7, and 7/8 are thickened; 8/9 and 9/10 are absent; 10/11–13/14 are slightly thickened.

The gizzard is elongate, often with an enlarged posterior rim, the intestinal cæca are long, extending from xxvii. into xxii. There is a slight longitudinal ridge on the inner wall of the intestine in the mid-dorsal region from the beginning of the intestine, but there is no characteristic typhlosole until the region of segments xxv.–xxvii. The typhlosole ends 50–60 mm. from the posterior end of the worm.

There are white masses of acinous blood-glands in segments v. and vi., and fairly large paired lymph-glands from segment xv. posteriorly.

There are large nephridial masses dorso-lateral to the alimentary canal in segments v. and vi.

The last pair of hearts is in xiii. In the combined gizzard-segment there are three pairs of commissural vessels as in *f. typica* (P), with the commissures of ix.-xiii. passing into the ventral blood-vessel.

There is a longitudinal suboesophageal sheet of tissue in segments xi.-xiv. as previously described.

The anterior testis-sacs are flattened against septum 10/11 with no apparent communication between the two sacs. The posterior sacs are conical and continued forward to the posterior face of 10/11 to which they are attached just above the place of emergence of the first pair of sperm-ducts. The sperm-ducts come

Fig. 6.

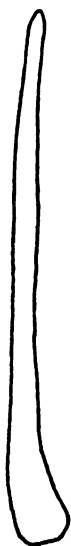
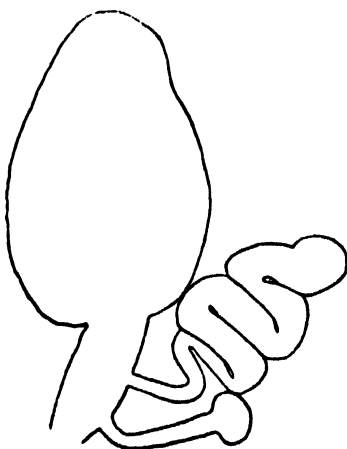


Fig. 7.



Fig. 8.



*Pheretima houletti* (E Perr.), var. (P) *tortuosa*.

Fig. 6.—Penial seta.  $\times$  ca. 110.

Fig. 7.—Tip of penial seta.  $\times$  ca. 275.

Fig. 8.—Spermatheca.  $\times$  ca. 16.

together in segment xii. and unite. They lie loosely on the ventral parietes and are easily traced. The paired seminal vesicles in xi. and xii. are large, lobed, and in contact with the dorsal blood-vessel.

The prostates are large, lobed, and lie in segments xvi.-xxi. The duct is about 5 mm. long with three or four loops, which are not constant in arrangement. The duct passes into the wall of the copulatory chamber on the side away from the nerve-cord (outer face). Behind the copulatory chamber and concealed under

septum 18/19 are one, two, or three glands, with ducts passing forward to the posterior wall of the chamber. Similarly, anterior to the chamber are three to eight glands with conspicuous ducts passing up on to the roof of the chamber or to the inner face. These ducts are more readily visible than in *typica* (?).

The copulatory chamber can be dissected off from the parietes, slit open on one side, and turned inside out. The inner walls of this chamber are covered with small papillæ which may or may not be arranged in groups of three or four. Projecting conspicuously into the chamber is a single large papillaceous mass. This varies a great deal in appearance, but usually consists of a stalk, on the free end of which are borne three papillæ, often curiously arranged so as to suggest qucer-shaped heads of birds or animals. Surrounding the stalk at the region where it passes into the wall of the chamber is a raised ring of tissue which may or may not bear papillæ scattered on its surface. In some of the worms the stalk is bent at right angles to itself.

Embedded in the walls of the chamber and projecting into the cavity between the papillæ are three to five setæ, which must be regarded as penial setæ (figs. 6 and 7). These setæ are 0.65–0.85 mm. long and about 60–70  $\mu$  thick at the widest place, straight or with a slight bend at the inner end, the free tip ending in a very fine spine, the end of which is rounded. The free end is ornamented with numerous short transverse ridges of fine spines similar to those on the ventral setæ of the anterior segments. One or two setæ in the body-wall immediately internal to the copulatory chamber may also be enlarged and ornamented, but such setæ are usually more sigmoid in form than the real penial setæ. Setæ *a* from this segment is sigmoid, 0.4–0.55 mm. long and 35–45  $\mu$  thick.

The ovaries and oviduct-funnels are in the usual positions in segment xiii. Occasionally small, paired, stalked, ovoid bodies are present on the posterior face of septum 13/14. The ovoid enlargement at the end of the stalk is attached to the septum at the side of the œsophagus, and the duct or stalk can be traced ventrally nearly to the region behind the oviduct funnel.

The spermathecal duct (fig. 8) is about half as long as the ampulla or less. The ampulla is flattened. The diverticulum arises from about the middle of the outer face or side of the duct, or lower down. It is at first rather thin, but the free end is much enlarged. The diverticulum is looped; there are five of these loops arranged in a "zigzag" manner, the arms of each loop except those of the first are in contact, and all the loops lie in the same plane. Usually a single spherical gland with a long stalk passes into the spermathecal duct at various places, usually below the point of attachment of the diverticulum to the duct. In addition to this gland there may be one to three more accessory glands which may or may not also pass into the spermathecal duct. In segment vii. the stalks of all accessory glands pass into the spermathecal duct. In segment viii. there is usually one accessory gland,



the stalk of which passes into the spermathecal duct, and one to three similar glands, the stalk or stalks of which can be traced to the papillæ in the intersegmental furrows internal to the spermathecal pore. In segment ix. the stalks of one or two glands pass into the spermathecal duct, and the stalks of one or two more pass into the body-wall to open independently in 8/9. The numbers of these accessory glands vary as has been indicated; rarely the parietal glands may be lacking, much more rarely the duct-glands may also be lacking. Glands with double heads, or with a common stalk for a short distance before entering the spermathecal duct or the parietes, are fairly common.

The clitellar setæ are usually bifid, about 0.16–0.2 mm. long, nearly straight with a slightly enlarged ectal end about  $20\mu$  in diameter. Very rarely slightly longer setæ with the tip unmodified are found.

*Remarks.*—This worm differs from *typica* (?) in the following respects:—

1. Larger size.
2. Character of prostomium.
3. Constant position of the first dorsal pore in 11/12.
4. Seta *a* not enlarged posterior to the clitellum.
5. Smaller ventral break in the setal circle.
6. Slightly smaller numbers of setæ on the anterior segments.
7. Absence of dorsal pores on the clitellum.
8. Greater number of setæ between the apertures of the copulatory chambers.
9. Presence of penial setæ.
10. Shorter spermathecal duct.
11. Greater number of accessory glands in connection with the spermathecae.
12. Manner of looping of the spermathecal duct.

In regard to characters 3–10, the present worm also differs from the account in the 'Fauna' volume.

The general appearance of these two varieties both externally and of the internal organs in dissection is much the same. Both have bifid clitellar setæ, and similarly enlarged, modified, and ornamented ventral setæ on the anterior segments; the testis-sacs and the seminal vesicles of both are practically the same in appearance. The accessory spermathecal glands of both are the same in size and appearance. The spermathecal diverticulum is very similar in both, differing chiefly in the attachment to the duct and the amount and manner of coiling or looping.

With perhaps a single exception, the differences noted above are hardly great enough to warrant the separation of this worm from *P. houletti* as a distinct species. The exception is the presence of definite penial setæ. This perhaps would usually be enough to warrant the separation, especially in view of the rarity of these structures in the genus *Pheretima* (known only from *P. osmastonii* and *P. harrietensis*), were it not for the very close external and

internal resemblances, and the common possession of the modified clitellar and ventral setæ, with *P. houlleti*. It has, therefore, seemed best to describe the worm for the present as a variety of *P. houlleti*.

Rosa described a worm from Palon, about sixty miles or so north of Rangoon, on the Proine road, under the name of *P. campanulata*. This has been regarded by other workers on this group of animals as a synonym for *P. houlleti*. Rosa called attention to five differences between the two worms as then known, the only one of which that is now of importance is the spermatheca. Rosa's description agrees more in detail with that of the present worm than either of these two agree with the description of this structure with *P. houlleti*. The term with which he characterizes the diverticulum of his specimens ("zigzag") applies equally well to the present forms. The figure which Rosa gives for the spermatheca agrees in the main with the present worm, the chief difference between the two being that in the Rangoon worms the free end of the diverticulum is enlarged and more or less ovoid rather than tapering and pointed as in Rosa's figure. The number of loops (five) is the same in both. Rosa, however, does not give sufficiently detailed information in regard to the other points—in particular, those listed above (1-11).

Var. *rugosa* (†), nov.

*External Characteristics*.—Length 110-140 mm. Diameter 4-6 mm. Number of segments 97-125. Colour brownish dorsally, except anterior to the clitellum where the brown is replaced by a bluish-grey shade. Ventrally whitish. Clitellum yellowish to brownish.

The prostomium is combined pro- and epilobous, but the transverse furrow at the end of the tongue in i. may be lacking.

Segments vii.-xiii. usually have two secondary furrows, one anterior to and the other posterior to the setal circles. Occasionally on these segments there are additional slighter furrows, which, as a rule, are not complete all round the segment.

The first dorsal pore is in furrow 11/12 in every case.

The setæ begin on segment ii. On segments ii.-ix. the ventral setæ are enlarged, irregularly spaced, and conspicuously projecting. The dorsal setæ may or may not be enlarged and irregularly spaced. A dorsal and ventral break is not usually determinable in segments ii.-vi. A slight dorsal break is usually present on segments ix.-xiii. and a ventral break on vii.-xiii. On ix.-xiii. seta *a* is much more enlarged than *b*, *c*, *d*, etc., which diminish in size regularly outwards. Posterior to the clitellum there is a conspicuous ventral break, *aa* being equal to  $1\frac{1}{2}$ -2*ab*. Seta *a* is much enlarged and conspicuously projecting. Setæ *b*, *c*, *d*, etc., as well as the intersetal intervals, diminish regularly outwards. There is a dorsal break, *zz* being equal to  $1\frac{1}{2}$ -2*yz*. The numbers are v./27-29, ix./49-50, xii./53-57, and xix./59-61. The enlarged conspicuously projecting ventral setæ are nearly straight and ornamented with short transverse ridges similar to those of the ventral

setæ of the other two varieties, except that in the present variety the ridges appear to be much more numerous and more closely crowded together. On segments xvii., xviii., and xix. seta *a* on each side is nearly straight and ornamented, but in this case the ridges are few and not so close together. Passing outwardly from *a*, setæ *b*, *c*, etc., become smaller, more sigmoid in form, and gradually lose the ornamental ridges. Seta *a* similarly becomes more and more sigmoid on passing posteriorly.

The clitellum is ring-shaped, and complete, extending from 13/14 to 16/17 in all cases. Intersegmental furrows and dorsal pores are not visible. Setal circles are present and complete on all the clitellar segments.

There are no spermathecal pores.

The female pore is at the bottom of an oval concavity on xiv. in the setal circle. The concavity and the pore are both more conspicuous than in either of the other varieties.

On segment xviii. in the setal circle are the apertures of the copulatory chambers. Each aperture is surrounded by a circular lip on which the setæ are lacking. The lip is finely wrinkled and wider on the side near the pigmented lateral region than elsewhere. The dorso-lateral coloration ceases at the outer edge of this lip. The aperture narrows at the bottom of a concavity to a longitudinal slit which opens into the chamber. No worms have been found in which the chamber is everted as a porophore, but this doubtless occurs as in the other varieties. Between the apertures are six to eight setæ.

*Internal Anatomy.*—Septum 4/5 is present; 5/6, 6/7, 7/8 very slightly thickened; 8/9 and 9/10 are absent; 10/11–14/15 are very slightly thickened.

The gizzard is elongate, often with a posteriorly enlarged rim. The intestinal cæca extend from xxvii. into xxii. There is a slight ridge on the inner mid-dorsal intestinal wall from xvi. to xxv. or xxvi. The typhlosole begins in this latter region and ends 55–70 mm. from the posterior end of the worm.

There are white masses of acinous blood-glands in segments v. and vi. and paired lymph-glands, rather large, from xv. posteriorly.

There are large nephridial masses in segments v. and vi. dorso-lateral to the alimentary canal.

The last pair of hearts is in xiii. In the combined gizzard-segment there are three pairs of commissural vessels as in *f. typica* (P) with the commissures of ix.–xiii. passing into the ventral vessel.

There is a longitudinal subœsophageal sheet of tissue in segments xi.–xiv., as previously described.

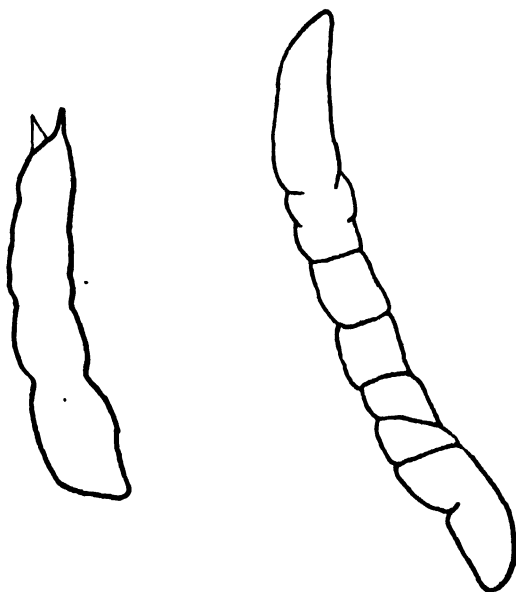
The anterior testis-sacs are flattened against septum 10/11 with no apparent communication between the sacs. The posterior sacs are conical and continued forward to the posterior face of 10/11, to which they are attached just above the place of emergence of the first pair of sperm-ducts. The sperm-ducts come together in segment xii. and unite. They lie loosely on the ventral parietes and

are easily traced. The paired seminal vesicles in xi. and xii. are small. They usually consist of two or three distinct lobes, of which one is quite regularly much smaller than the other two.

The prostates when fully developed lie in segments xvii.-xx. Very often these glands are poorly developed, represented only by two small lobes, or they may be entirely lacking. In the latter case the prostatic duct may or may not be present. The duct is 2 to 3 mm. long, looped two or three times in various ways, and passes into the wall of the copulatory chamber on the side away from the nerve-cord (outer face). Behind the copulatory chamber

Fig. 9.

Fig. 10.



*Pheretima houletti* (E. Perr.), var. (P) *rugosa*.

Figs. 9 & 10.—Clitellar setæ.  $\times$  ca. 265.

are usually two glands with ducts running forward to the posterior wall. Anteriorly there are three to eight similar glands with the ducts passing up on to the roof of the chamber or to the inner face. These ducts are more conspicuous than in the other varieties.

The inner wall of the copulatory chamber is covered with pore-bearing papillæ similar to those of *f. typica* (P). These papillæ are of various sizes and crowded closely together like those of *tortuosa*. In the region where the prostatic duct passes into the wall of the chamber there is a group of four or five papillæ closely

crowded together. There are no setæ embedded in the walls of this chamber.

The ovaries and oviduct-funnels are in the usual positions in segment xiii. There are no spermathecae. Large numbers of apparently fully mature worms have been examined without finding one with spermathecal pores. Dissection of numbers of specimens has failed to reveal any trace of these structures.

The clitellar setæ are bifid (fig. 9), 0.12–0.15 mm. long. There are numerous irregular transverse furrows running around the shafts of these setæ, producing a characteristically wrinkled appearance. Larger setæ, 0.2–0.25 mm. long, are present (fig. 10). These are much less frequent than the smaller type and the end is not bifid. The shaft has the same wrinkled appearance as the smaller setæ.

*Remarks.*—This worm differs from *f. typica* (?) in the following points:—

1. Larger size.
2. Constant position of the first dorsal pore in 11/12.
3. Slightly greater number of setæ per segment.
4. Absence of dorsal pores on the clitellum.
5. Absence of spermathecae.
6. Smaller size of the seminal vesicles.
7. Smaller size or rudimentary condition of the prostates
8. Transverse furrows on the clitellar setæ.

In respect of points 3, 5, 6, 7, and 8, this variety also differs from variety *tortuosa*. It has in common with the other two worms the following characteristics:—

1. Complete rings of setæ on the clitellar segments, most of the setæ short and with bifid tip.
2. Ventral setæ on the anterior segments enlarged, modified in form, and ornamented with similar transverse ridges.
3. General appearance of the testis-sacs.
4. Accessory glands in connection with the prostates with ducts opening into the lumen of the copulatory chamber.
5. Absence of genital papillæ.

The classification of these three worms is something of a puzzle, due largely to the handicaps under which workers in this province labour. For instance, Perrier's original description of this species is in the author's library, but many details of structure to which it is necessary to refer in the present case are omitted by Perrier. Other authors have contented themselves, as far as available literature is concerned, with simply recording the species from the various localities without giving any details of structure. Michaelsen's account in the 'Tierreich' volume, and Stephenson's in the 'Fauna' volume, the only other descriptions available locally, are, of course, summaries which do not mention certain points on which information is desired. Furthermore, it has not been

possible to compare the local specimens with identified museum specimens of the species. It has therefore seemed best to describe these three worms tentatively as three varieties of the species. The variety which differs the least from Perrier's original account and from Stephenson's account in the 'Fauna' volume is referred to as the f. *typica* (?) and the other two as new varieties, with an interrogation point after the word variety to indicate that there is some doubt as to the varietal status.

It is perhaps quite to be expected that a species with such a wide-spread distribution should show certain varietal differences, although neither Michaelsen nor Stephenson mention any such varieties. This may possibly be due to a lack of adequate study of representatives of this species from the various areas. Several species have been described which resemble more or less closely *P. houletti*. Certain of these have been relegated to the synonymy, while others have been retained. Students of the Oligochæta, however, do not seem to be agreed as to which are valid species. A re-investigation of the whole situation should be made.

*Pheretima lignicola*, Steph.

The commissures of segment viii. passing to the gizzard are small. One of the pair belonging to ix. is very much larger than the other. The commissures of x. and xi. are about the same size as the larger one belonging to ix.; they connect the supra-oesophageal and ventral vessels. The commissures of xii. and xiii. are much larger and also pass to the ventral vessel. The commissures of xi. are almost entirely within the testis-sacs of the segment, and the ventral two-thirds or three-quarters of the pair of x. are also within the testis-sacs of that segment. There is a suboesophageal sheet of tissue forming a longitudinal chamber under the alimentary canal as in *P. peguana*. The sheet extends from just behind the commissures of ix. through segment xiv.

*Occurrence*.—This worm is found in Rangoon only from July to October inclusive.

*Pheretima peguana* (Rosa).

This species has been discussed in a previous paper, but as it is peregrine mention of it is made here. It is not, however, so widely distributed as most of the rest of the peregrine forms found in Rangoon. Outside of Burma it has only been reported from Siam and Java. Since the publication of the previous paper three abnormal specimens have been found which are described herewith.

1. *External Characteristics*.—Length 98 mm. Diameter 5 mm. The worm is normal except in the male region on the right side. Here there are two genital markings of the usual size, but instead of occurring on furrows 17/18 and 18/19 both are actually on segment xviii., extending from the setal circle anteriorly to 17/18 or

posteriorly to 18/19. There is no male porophore visible in the setal circle.

*Internal Anatomy.*—There are no funnels in the testis-sacs of the right side. The prostate with its duct on this side is also lacking, as are the glands corresponding to the external genital markings.

2. Length 116 mm. Diameter 5-6 mm. Clitellum lacking on segment xvi. from just to the left of the dorsal pore in 16/17 to just internal to the inner border of the genital markings on xvi. The male pore of the right side is in the setal circle of xvii. The genital areas on this side are on 16/17 and 17/18. The prostatic duct is in segment xvii. on the right side. The accessory glands are in xvi. and xviii.

3. *External Characteristics.*—Length 116 mm. Diameter 6 mm. The first dorsal pore is in 12/13. There is a female pore in xiii. in the setal circle slightly to the right side. The female pore of xiv. is slightly to the left of the one on xiii. and about in the centre of the segment. The male porophore and the accessory papillæ are normal on the left side. On the right side there is a large genital marking on 16/17, a male porophore on xvii. in the setal circle, and a normal-sized genital marking in 17/18.

*Internal Anatomy.*—The anterior pair of seminal vesicles is large and in contact with the gizzard. In segment xii. on the left side there is a medium-sized seminal vesicle. The vesicle of the right side is a small rudiment on the posterior face of septum 11/12. On the right side of this segment there is an ovary and an oviduct-funnel in the usual positions. In segment xiii. there is a heart on the left side, that of the right side lacking. A single ovary is present on the left side and an unusually small oviduct-funnel is present on the same side. The right prostate lies in segments xvi.-xviii. with the duct in xvii., the left prostate lies in xvi.-xix. with the duct in xviii. The spermathecal pores are not visible exteriorly, but all the spermathecæ are present except the last one on the right side.

### *Pheretima posthuma* (L. Vaill.).

*External Characteristics.*—Length in the rainy season 110-140 mm., in the dry season 60-120 mm. Diameter in the rainy season 5-7 mm., in the dry season 3-5 mm. The colour varies and may be almost white, light grey, slaty grey, or dark brownish grey. The greyish appearance is often heightened by the very black humus present in the alimentary tract.

The prostomium is prolobous, or combined pro- and epilobous.

A single secondary furrow is usually present posterior to the setæ on segments v.-xiii., and a second furrow anterior to the setæ is usually present on most or all of segments vi.-xiii. On segments posterior to the clitellum there are two secondary furrows marking off a ridge which bears the setæ.

The first dorsal pore is in 12/13.

The setæ begin on ii., and are present in unbroken rings. The setæ are all approximately of the same size.

The clitellum is ring-shaped and on xiv.-xvi. (=3), although quite often the clitellar thickening is lacking posterior to the setæ of xvi. ventrally, or both dorsally and ventrally. The colour is reddish or yellowish. Dorsal pores are usually absent, but setæ are present. The setal circle of xiv. is interrupted by the oval area containing the female pore.

The male pore is a minute aperture on the centre of a round glistening papilla on the wall of the copulatory chamber. This chamber opens to the exterior by a large aperture in the setal circle of xviii., around which the parietes are much wrinkled and swollen. When the chamber is fully everted it forms a conical projection, at the top of which lies the pore-bearing papilla. Between the openings to the copulatory chambers are 18-22 setæ.

The female pore is single on xiv., in or anterior to the setal circle, at the centre of an oval whitish area.

The spermathecal pores are four pairs, located in furrows 5/6, 6/7, 7/8, 8/9, one-third or more of the circumference apart, the position of each pore indicated by a minute papilla on the posterior part of the segment in contact with the intersegmental furrow behind.

Normally, there are two pairs of copulatory papillæ, one pair in the setal circle of xvii. and the other in the setal circle of xix. These papillæ are transverse nearly oval swellings extending anteriorly and posteriorly to the intersegmental furrows of the segment, and narrowing at both ends until continuous with the ridge bearing the setæ of the segment. Nearly all of the flat top of the swelling is occupied by a greyish circular depression, which is surrounded by a slight ridge, immediately outside of which is a single slight but evident circular furrow. This is close to the intersegmental furrows. The swollen parietes below the ridge may have other shorter and slighter furrows. The centre of the depression of the papilla is internal to the centre of the opening of the copulatory chamber on xviii.

*Internal Anatomy.*—Septa 5/6, 6/7, and 7/8 are much thickened; 9/10 is absent; 10/11 and 11/12 are slightly thickened.

The gizzard is subspherical. The walls of the œsophagus posterior to the gizzard are corrugated internally by circular, highly vascular ridges. The caeca are long and slender, arising in xxvi. and often turned dorsally and confined to that segment, more rarely extending forward into xxv. or xxiv. The intestine begins in xv. The small typhlosole begins in the region of segment xxvii. and ends 15-25 mm. from the posterior end of the worm. There are large nephridial masses dorso-lateral to the alimentary canal in v. and vi.; large reddish masses of acinous blood-glands in v.; and large paired whitish lymph-glands in xxv. and posteriorly, increasing in size until the middle of the body and then decreasing.

The last hearts are in segment xiii. The commissures of segments viii. to xiii. are as described by Bahl as typical for the genus.



The anterior pair of testis-sacs is attached to septum 10/11. Posteriorly and ventrally the sacs are in contact, but there is no communication between the sacs, as the contents are separated by a thin tough membrane. The posterior pair of testis-sacs is in xi. No partition can be demonstrated between the two sacs where they are in contact posteriorly. The sperm-ducts of a side come into contact in xii., but the lumina of the two ducts do not fuse until much further posteriorly. The seminal vesicles are paired in xi. and xii., lobulated and in contact dorsally over the digestive system.

The prostates are irregularly lobed bodies extending from xvi.—xxi. at their largest. The duct is much thicker ectally than entally and bent in the form of a horseshoe with the concavity opening outwards, and the thinner limb placed anteriorly.

The ovaries are leaf-shaped bodies flattened against the posterior face of septum 12/13. The oviduct funnels are in the usual position on 13/14.

The spermathecae are four pairs—one pair in vi., one pair in vii., and two pairs in viii. The shape and size of the ampulla varies. It may be ovoid, heart-shaped, spherical, much longer, the same length, or even shorter than the duct. The duct is not sharply marked off and varies in length absolutely and relatively to the length of the ampulla. The single diverticulum arises on the inner side of the duct, close to the body-wall, and consists of a very fine stalk and a longer finger-shaped enlargement. The free end of the diverticulum may be separated longitudinally into two halves. More rarely the diverticulum is completely divided into two longitudinally, except for a common junction before passing into the duct. More rarely still, two spermathecae open to the outside by a single pore.

Small, flattened, softish, sessile glands close to the parietes correspond in position internally to the copulatory papillae.

*Occurrence.*—This worm is found in Rangoon all the year round.

*Remarks.*—The Rangoon worm differs from the account in the 'Fauna' volume in the following points:—

1. Prostomium.
2. Occasional incompleteness of the clitellum on xvi.
3. Persistent absence of 9/10.
4. Absence of seminal vesicles in x.

Several writers have called attention to the occasional occurrence of the characteristic copulatory papillae on segments other than xvii. and xix. As specimens were frequently brought into the laboratory showing this condition, it seemed desirable to obtain further information as to the frequency of occurrence of such papillae. The laboratory mahli was, therefore, sent out one day with instructions to collect only specimens of this species. As a result of the day's work 328 of these worms were secured. Of this number 256 were normal so far as these were concerned, 16 were not yet fully mature and were disregarded, while 56 mature worms

(or nearly 18 per cent. of all the adult worms obtained) showed various abnormal or unusual arrangements of these papillæ. These various conditions may be grouped into three classes:—

- A. Papillæ lacking on some or all of the usual positions on segments xvii. and xix. In some way the development of these papillæ has been prevented. The genital markings appear in the younger worm long before the clitellum. The setal circles at the site of the missing papillæ are unbroken. 9 specimens.
- B. Papillæ are lacking on segments xvii. and xix., with extra papillæ on other segments. 18 specimens.
- C. No papillæ are lacking on segments xvii. and xix., and extra papillæ are present on other segments.—29 specimens.

TABLE A.

Group A.

Papillæ lacking on segments	Number of specimens.
xix.	1
right xix.	3
left xix.	3
right xvii.	1
xvii. and xix.	1

Group B.

Papillæ lacking on segments	Extra papillæ present on segments	Number of specimens
right xvii.	right xx.	4
left xvii.	left xx.	4
left xix.	right xvi.	3
left xvii.	right and left xx.	2
right xix.	left xx. and right xxii.	
	right xxiii.	1
right and left xvii.	right and left xx.	2
right and left xvii.	right xx.	2

Group C.

Additional papillæ present on segments	Number of specimens.
left xvi.	1
right xx.	9
left xx.	9
left xxi.	1
right xxi.	1
left xxii.	2
left xxiii.	1
right xxvii.	1
left xxvii.	1
left xxi. and right xxii.	1
left xx. and right xxiii.	1
right xxii., right xxiii., right xxiv., right xxv., right xxvi., left xxv., left xxvi.	1

Since making the above-mentioned collection all abnormal specimens of this species brought into the laboratory have been studied and tabulated, but no further records as to the proportion of normal

and abnormal specimens have been kept. Later specimens have been tabulated in Table B.

TABLE B.

## Group B'.

Papillæ lacking on segments	Additional papillæ present on segments	Number of specimens.
right xvii.	left xx.	1
right xvii.	right xx.	4
right xvii.	right xxi.	2
right xvii.	left xxii.	1
right xvii.	right and left xx. and right xxi.	1
right xvii.	right xxi., right xxiii.	1
right xvii.	right and left xx., right xxi., right and left xxii.	1
left xvii.	left xx.	2
left xvii.	right xx.	1
right and left xvii.	right and left xx.	1
right and left xvii.	right and left xx., left xxi., right xxii., right xxiii.	1
right xvii., right xix.	right and left xx.	1
right xix.	left xvi.	1
right xix.	right xx., right xxi., right xxviii.	1
left xix.	left xvi.	5
left xix.	left xvi., right xx., right xxi., right xxii.	1
right and left xix.	right and left xvi.	1

## Group C'.

Additional papillæ present on segments	Number of specimens.
right xvi.	1
left xvi., left xxii.	1
right and left xvi., right xx.	1
right xx.	7
right xx., right xxi., right xxii.	1
right xx., right xxii.	1
right xx., right xxi., right xxii., right xxvi.	1
right xx., left xxiii.	1
right xx., right and left xxii.	1
left xx.	8
left xx., left xxiii., right xxiv.	1
right and left xx.	3
right and left xx., right xxi.	2
right and left xx., right xxiii.	1
right xxi.	2
right xxii., right xxiv., right xxv.	1
left xxii., left xxiii., right xxiv.	1
left xxiii.	1
right xxiv.	1
right xxvi.	4
right xxvii.	1

Note.—In the Tables above right or left previous to the number of a segment means that a papilla was present or lacking on the side of the segment specifically indicated, presence or absence indicated by the column.

*Accessory Prostates.*—Stephenson has noted the occurrence of these organs in segment xvii. They may also occur in segments xix. and xx. There may be a single accessory prostate present in any of the segments mentioned, or there may be a pair of prostates. The position of these accessory organs is indicated externally by the presence of the large apertures or conical porophores exactly similar to those present on xviii. and in the same position. The largest number of prostates found in one worm is five. This worm has characteristic male porophores on the left side on xviii and xix., on the right side on xviii., xix., and xx. Internally there are prostates corresponding to each of these pores. Each prostate and duct is similar in appearance to the normal glands in xviii., except for size and connection with the vas deferens.

*The Sperm-ducts.*—Lloyd states that the male generative tube of a side is "double in its whole length," and gives a camera lucida drawing of low and high magnifications, showing the double characteristic. Powell, replying, states:—"In no case have I found two ducts completely separate as described and drawn above by Capt. Lloyd. In some a slight grooving and fluting could be seen, but in all cases the duct or ducts were firmly united in a common outer fibrous (?) coat. In one sectioned worm there was a single lumen lined by a single layer of epithelial cells. In the other there were two distinct lumina firmly bound together by a common outer coat. . . . In no case could any student dissect or separate the ducts from one another."

It is apparent from Powell's own description of the two sections that the conditions of the male ducts may vary somewhat in this species, and it is possible that all the conditions mentioned occur. It does not seem probable that the ordinary student would be sufficiently skilled or provided with fine enough instruments to dissect apart or separate these ducts.

The condition of the male ducts in the Rangoon forms resembles the condition described by Lloyd for the Calcutta forms. In the local worms the vasa deferentia come into contact just behind the funnel of segment xi. The duct lying on the floor of the segments is conspicuous, and even with very low magnification a thin grey line can be seen which divides the duct into two longitudinal halves and which causes the fluted appearance mentioned by Powell. This thin grey line continues into the posterior part of xvii. and occasionally even into xviii. The ducts can be easily removed, as there is little attachment to the body-wall. When examined microscopically, they have the appearance figured by Lloyd. It is also possible to dissect or separate the ducts. This is done most easily by grasping each funnel with a pair of fine forceps after the tissue binding the duct to the parietes is cut, and slowly pulling the ducts apart.

#### *Descriptions of Abnormal Specimens.*

1. *External Characteristics.*—Length 95 mm. Diameter 4 mm. The first dorsal pore is in 10/11. The clitellum is on segments xii.—

xiv. (=3) and is incomplete ventrally on most of xiv. The female pore is on xii. just anterior to the setæ. The male pores are on xvi. There is a pair of spermathecal pores in 5/6 about one-third of the circumference apart, one pore in 4/5 on the left side, and another pore in 6/7 on the right side. There is a pair of normal copulatory papillæ on xiv., between which the clitellar thickening of the ventral parietes is lacking, and a second pair on segments xv. and a single papilla on the left side of segment xxiv.

*Internal Anatomy.*—Septum 5/6 and 6/7 are much thickened, 7/8 is missing. The gizzard is in segment vii. The intestine begins in xiii. There are large nephridial masses dorso-lateral to the alimentary canal in segment v. only. The last pair of hearts is very large and in segment xi. The hearts of v. are also large. The commissures of viii. and ix. are small and difficult to trace. The commissures of vii. are large and pass to the gizzard.

On the anterior face of septum 8/9 are two small testis-sacs, each of which contains a funnel and testicular tissue. These sacs are not in contact or communication ventrally or posteriorly. There is a very thin spot on each portion of the septum which forms the posterior wall of the testis-sac. There is no trace of a sperm-duct passing posteriorly from the funnels in these sacs. In ix. there is a very large pair of male funnels on 9/10, but no testicular tissue can be found. A large single sperm-duct passes from each funnel to the prostatic duct. There is a pair of small seminal vesicles in segment x. The ovaries and oviduct-funnels are in segment xi. in the usual position. The prostates are confined to segment xvi., widely distending 15/16 and 16/17. The four spermathecæ are located in the segments indicated by the external pores.

*Remarks.*—In this specimen the clitellum, the male and female pores, the ovaries, prostates, testis-sacs, and funnels are two segments anterior to their usual position, but the gizzard is only one segment anterior to its usual position. Commissures corresponding to those of segments xii. and xiii. in the normal worm (supra-oesophageal to ventral vessels) are present in x. and xi., those corresponding to the commissures of x. and xi. (supra-oesophageal to lateral oesophageals) are present in this specimen in viii. and ix., while the commissures corresponding to those of segment ix. (dorsal to ventral vessels) are absent. The commissures belonging to segment viii. in the normal worm are in vii. in this specimen. If two segments are imagined to be intercalated between what is now segment vii. and the following segment, and the gizzard pushed back into the first of the intercalated segments, the worm becomes normal except for the spermathecal positions.

2. *External Characteristics.*—Length 69 mm. Diameter 8 mm. Immature. Clitellum not yet visible. Spermathecal pores in 5/6–8/9. Female pore on xiii. The male pore of the right side on xvi. and of the left side on xvii. There is a copulatory papilla on xvii. on the right side and on xviii. on the left side.

*Internal Anatomy.*—Septum 8/9 is absent, 9/10 is present and thick, the gizzard is in viii. The last pair of hearts is in xii. The intestine begins in xiii. There is a pair of testis-sacs on 9/10 containing testicular tissue and funnels. Medium-sized seminal vesicles are present in xi. A pair of minute stalked seminal vesicles is visible on the posterior face of 11/12. The ovaries and oviduct-funnels are in xii. The spermathecae and prostates are small and corresponding in position to the external indications.

3. *External Characteristics.*—Length 112 mm. Diameter 4–5 mm. Number of segments 108. The first dorsal pore is in 12/13. The clitellum extends from 13/14 to 16/17 on the left side and just behind the setae of xiv. to just behind the setae of xvii. on the right side. The transition from unmodified to the clitellar epidermis dorsally and ventrally at both the anterior and posterior ends is so gradual as to be practically imperceptible, and hence it is difficult to describe the exact boundary of the regions. The papilla of the right side on xvii. intrudes into the clitellar region. Setae are present on all the clitellar segments, but the dorsal pores are lacking. The spermathecal pores are in 5/6 to 9/10 on the right side and 5/6 to 8/9 on the left side. There are two female pores, one in the setal circle of xiv. and one in the setal circle of xv. There are the usual copulatory papillae or genital markings on segments xvii. both right and left sides, on the right side of xviii., and on the left side of xix. The male porophores are on xviii. on the left side and on xix. on the right side.

*Internal Characteristics.*—Septum 4/5 is thickened nearly as much as 5/6 and 6/7. In x. there is a single large testis-sac on the left side. On the right side there is no testis-sac, but there is a spermatheca opening to the exterior through a pore in 9/10. In segment xi. there is a single medium-sized testis-sac on the right side. There is no testis-sac on the left side, but there is a single free funnel on the anterior face of septum 11/12.

The sperm-duct of the right side is single and about half the usual size. The sperm-duct of the left side is twice the size of the duct of the other side and is double, with a thin grey line marking exteriorly the double character. There are large paired seminal vesicles in both xi. and xii. There is a pair of ovaries and oviduct-funnels in the usual positions in segment xiii. In addition, there is in this segment a pair of structures somewhat resembling rudimentary seminal vesicles. These are small ovoid-shaped bodies less than a millimetre long and situated on the posterior face of septum 12/13, one on each side of the alimentary canal. Ventrally this body continues as a fine duct-like stalk along the septum nearly to the level of the ovary, where it can be traced no further. In segment xiv. there is an ovary and oviduct-funnel on the right side only. The last heart is on the right side of this segment. The prostates are large and extend through segments xvii.–xxi. The duct of the right prostate is in segment xix. and of the left prostate in segment xviii. The sperm-duct of the right side passes

up on to the free surface of the gland of segment xviii. and thence through septum 18/19 into xix., where it joins the prostatic duct in the usual manner.

*Perionyx excavatus*, E. Perr.

This worm has already been reported from Rangoon by Stephenson. It occurs in this city all the year round. There is considerable variation in size—the length, for instance, of mature specimens may be from 40–180 mm. The penial setæ of the smaller forms are slightly shorter and thinner than those of the larger worms.

*Perionyx fulvus*, Steph.

Previously reported from Calcutta and the Southern Shan States. It occurs in Rangoon all the year round.

*Glyphidrilus papillatus* (Rosa).

*External Characteristics.*—Length 74–105 mm. Maximum diameter 5–6 mm., diameter in the posterior part of the body 3–4 mm. Number of segments 131–225. The living specimens are flesh-colour, the preserved worms (formalin) are greyish.

Behind the clitellum the body of the worm is flattened both dorsally and ventrally. Anterior to the clitellum it is rounded. In the posterior half of the body, in the preserved worms, the dorsal and ventral sides are slightly concave.

The prostomium is large, zygotelobous.

The setæ are eight per segment and they begin on ii. They are not closely paired, and they are so situated that there are two on each dorsal, lateral, and ventral surface. Intervals *ab* and *cd* are nearly equal, *dd* is slightly greater than *aa*, which is slightly greater than *bc*.

On segments iv.–xiii. there are two secondary annulations per segment, one furrow anterior to and the other posterior to the setæ. On segments vii.–ix. on the most posterior and anterior annulus thus formed there may be slighter tertiary furrows.

Crinkled ridges or “wings” project ventrally from segments xix.–xxv., halfway between *b* and *c*. These ridges are filled with blood in worms that have just been killed, much more so than any other part of the body.

There are numerous genital markings. These are swollen oval areas extending from one intersegmental furrow to the next. At the centre of each of these areas is a small round papilla. These papillæ may be found in any or all of segments x.–xviii. and xxvii.–xxviii. in the middle of intersetal interval *aa*. Similar areas may occur on any or all of segments xv.–xviii. in the setal intervals *bc*, extending from just outside *b* to halfway to *c*.

*Pontoscolex corethrurus* (Fr. Müll.).

Length 96–116 mm. Diameter  $4\frac{1}{2}$ –5 mm., except in the region

of clitellum, which is wider than the rest of the worm and may be 6 mm. wide. Unpigmented. Clitellar segments are reddish, orange, or yellowish.

*Occurrence*.—All the year round.

Cocoons of this species have been obtained in the months of December to March inclusive and also in October.

#### REFERENCES.

- BAHL, K. N. 1921. "On the Blood-Vascular System of the Earthworm *Pheretima*, and the Course of the Circulation in Earthworms." *Q. J. M. S.* vol. lxxv.
- LLOYD, R. E. 1911. "Some disputed Points in the Anatomy of a common Indian Earthworm." *J. Bomb. Nat. Hist. Soc.* vol. xxi.
- PERRIER, E. 1872. "Recherches pour servir à l'histoire des Lombriciens terrestres." *Nouv. Arch. Mus. Paris*, vol. viii.
- POWELL, A. 1911. "Some disputed Points in the Anatomy of a common Indian Earthworm." *J. Bomb. Nat. Hist. Soc.* vol. xxi.
- STEPHENSON, J. 1914. "On a Collection of Oligochaeta, mainly from Northern India." *Rec. Ind. Mus.* vol. x.
- . 1917. "On a Collection of Oligochaeta from various Parts of India and Further India." *Rec. Ind. Mus.* vol. xiii.
- . 1923. "Oligochaeta." *Fauna British India Series*, London.
- . 1924. "On some Indian Oligochaeta, with a Description of Two new Genera of Oenetrodrilinae." *Rec. Ind. Mus.* vol. xxvi.

#### IX. — On several known and unknown Reptiles of the Order Saurischia from England and France. By Baron F. von HUENE, Tübingen.

THERE are still several Jurassic and Cretaceous carnivorous Saurischia in western European countries which are not yet sufficiently known. Here I propose to describe and re-describe eight species. The most important Megalosaurids I have treated recently on another occasion (*Rev. Mus. La Plata*, 1926). But, first, I should still like to say a few words on the classification and phylogeny of the Saurischia.

During the last few years several authors have given a systematic scheme of the Saurischia very different from mine, though they use some of the same terms, but not in the original sense. Therefore, it may be useful once more to refer to that system, which has been misunderstood.

In 1914 the Saurischia were first divided into two main groups, Coelurosauria and Pachypodosauria (4-10, especially 6 and 10 \*). The first group is separated from all other

\* Numbers printed in old-faced figures refer to the "Literature" at the end of this article (p. 488).



Saurischia by the whole character of their organisation, from the Trias to the Cretaceous. The Pachypodosauria are the opposite of the Coelurosauria, also from the Trias to the Cretaceous. That means that all Saurischia, which are not Coelurosauria, belong to the Pachypodosauria, as, for instance, the Plateosauridæ, the Megalosauridæ, and the Sauropoda. For the first, the bifurcation of the whole phylum is supposed to divide it into those two main groups.

The Pachypodosauria themselves soon bifurcate again into two groups—the carnivorous and the herbivorous, respectively. This can be recognized already in Triassic time. In 1920 I called the carnivorous group the Carnosauria. Triassic Carnosauria, for instance, are *Palæosaurus*, *Zanclodon*, *Teratosaurus*, and *Gresslyosaurus*. Descendants of them in the Jura are the Megalosauridæ and others, then several families in the Cretaceous. The Carnosauria were rapacious animals like the Coelurosauria, but the two are differently organized.

The second division of the Pachypodosauria is herbivorous, and perhaps also partly omnivorous. The Plateosauridæ in the Trias are supposed to give rise to the Jurassic and Cretaceous Sauropoda, hence that whole Triassic group has been called Prosauropoda. But they are both Pachypodosauria, as also are the Carnosauria, and all Pachypodosauria taken together are parallel again to the Coelurosauria.

Therefore it seems impossible any longer to use Marsh's term Theropoda, comprising our Carnosauria and Coelurosauria, for this now appears to be an unnatural grouping.

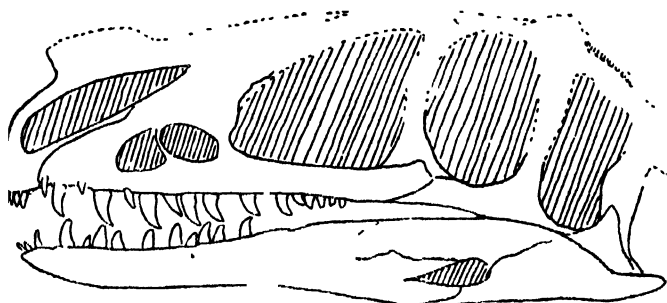
(1) "*Megalosaurus*" *bradleyi* (A. S. Woodward).  
(Fig. 1.)

This is a skull, incomplete in its upper half, from the Great Oolite of Minchinhampton, Gloucestershire. Its near relationship with *Ceratosaurus nasicornis* (20) has been pointed out and emphasized by A. S. Woodward. In fig. 1 I have attempted, according to the latter, to restore the missing upper part of the skull. There is no other material for a restoration than the original specimen and *Ceratosaurus nasicornis*. This skull (only 26 cm. in length) markedly differs in shape from the skull of *Megalosaurus bucklandi* and *Streptospondylus*, as well as that of *Antrodemus*.

The number of teeth is greater—namely, four in the præmaxilla (four are preserved and a fifth might have space behind them, but Woodward only speaks of four), eighteen in the maxilla (including two gaps). The teeth in the præmaxilla are provided with peculiar lateral flat longitudinal

folds, unknown except in this case, one near the top and numerous others at the base. *Ceratosaurus*, however, has not this higher number of teeth (but  $3 + 15$ ), and there are no lateral longitudinal ridges known on its teeth. Differing from the *Megalosaurids* is the shape of the external narial openings, which also does not agree with *Ceratosaurus*. More essentially different are the shape and breadth of the ascending process of the maxilla. Further, the height of the præorbita, resulting from its smaller angles, amounts to much more than in *Megalosaurus bucklandi* and *Streptospondylus cuvieri*; relatively smaller and narrower than in those are the orbita and the infratemporal fenestra. The posterior extremity of the maxilla is not bent downward as in the *Plateosauridæ*. The lateral temporal opening, as seen

Fig. 1.



Attempt at a restoration of the skull of *Proceratosaurus bradleyi*, from the Great Oolite of Minchinhampton,  $\frac{1}{4}$  nat. size.

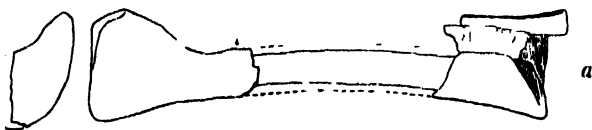
from the lower part preserved, must have been relatively broad in its whole height. By this the squamosal becomes more curved in the intertemporal arch, and so differs again from the *Megalosaurids*. The quadrate articulation has a lower articulation than it probably had in the *Megalosaurids*. As to all this the comb-like nasal prominence is added, which is not known elsewhere, I propose to distinguish this genus from the *Megalosauridæ* as *Proceratosaurus*, gen. nov.

(2) *Megalosaurus* from *Nethercomb*. (Figs. 2-4.)

These remains are part of the beautiful collection of the late James Parker, Esq., at Oxford, who very kindly gave me the opportunity of studying them. They were found at

Nethercomb, 1 mile north of Sherborne, Dorset, and are now preserved in the Oxford Museum. They consist of both lower jaws with teeth, one dorsal vertebra, both tibiae, and the right pubis. These remains, from the *Humphriesianus*-horizon of the Inferior Oolite, have not been described before. The (left) tibia, 48 cm. long, indeed, resembles rather much that from the Lower Lias of Wilmcote (A. S. Woodward, "Note on a Megalosaurian Tibia from the Lower Lias of Wilmcote, Warwickshire," Ann. & Mag. Nat. Hist.

Fig. 2.



"*Megalosaurus*" *nethercombensis*. Left tibia and fragment of the fibula,  $\frac{1}{2}$  nat. size. *a*, oblique medial-anterior aspect, location of the crista lateralis is indicated by a sign; *b*, outline of proximal articular face, completed by the right one.

(8) i. 1908, pp. 257-259, 1 fig.). The head of the tibia with the cnemial crest projects forward (fig. 2), and has a sagittal diameter of 12 cm., but in transverse direction it is narrow, as the proximal end of the right tibia demonstrates; it is only 8 cm. broad at the condyli. There is a slightly developed crista lateralis about 15 cm. below the upper end, whose distal part is broken off. Apparently it begins higher up, but there also the bone is damaged. The shaft, as far as

Fig. 3.



"*Megalosaurus*" *nethercombensis*. Fragment of right pubis,  $\frac{1}{2}$  nat. size. Medial aspect with transverse sections.

preserved, has only a small diameter (5 cm.). The whole bone seems to be slender, for a great part of its length there is only the cast of the internal cavity. The distal end of its anterior side exhibits laterally a broad triangular groove for the reception of the processus ascendens astragali, as distinct as in *Megalosaurus poikilopleuron*. The distal extremity of the left fibula is still connected by matrix with the left tibia.

There is also a fragment of the right pubis (fig. 3), 21 cm.

long, and possibly extending nearly to the distal end. Its distal part is rod-like and of almost oval transverse section; in the proximal half the median lamella begins to project, but it widens only to 4.5 cm. at the proximal break. That makes the pubis like that of *Megalosaurus*.

The same is to be said of the two lower jaws with teeth (fig. 4). The teeth, in the anterior half of their transverse sections, are thicker than in *Megalosaurus bucklandi*, the posterior edge is sharp and serrated, but at the anterior side

Fig. 4.



*Megalosaurus nethercombensis*. Anterior parts of both lower jaws, with teeth, the left one showing the lateral and the right one the medial aspect,  $\frac{1}{4}$  nat. size.

the teeth are broad, and only in their upper half is there a blunt edge. Of the vertebral centrum there is no measurements.

Hence this specimen must belong to primitive species, and I propose to call it *Megalosaurus nethercombensis*, sp. n.

(8) *Megalosaurus from the Oxford Clay of Weymouth.*  
(Figs. 5-11.)

These bones, from the Oxford Clay,  $1\frac{1}{2}$  miles north of Weymouth, Dorset, were also in the collection of the late

James Parker, Esq., at Oxford, and are now probably with that collection in the Oxford Museum. They comprise three dorsal vertebræ with high neural spines, four proximal caudal vertebræ, right ilium, fragments of right and left ischium, right and left pubis, right femur, and upper part of left tibia, and have never been described before.

Fig. 5.

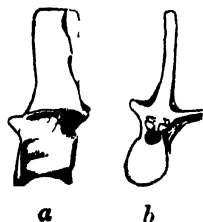


Fig. 6.



Fig. 5.—*Megalosaurus parkeri*, Oxford Clay, Weymouth, James Parker Coll., Oxford Mus. Dorsal vertebra,  $\frac{1}{2}$  nat. size *a*, from the left side; *b*, anterior aspect.

Fig. 6.—*Megalosaurus parkeri*. Lateral aspect of anterior caudal vertebra,  $\frac{1}{2}$  nat. size.

In both of the dorsal vertebræ the centrum is 11 cm. long, the whole vertebra is 37 cm. high, of which 21 cm. come to the neural spine, which is 9 cm. broad (fig. 5). The four anterior caudal vertebræ (fig. 6) must also have had high neural processes (their upper extremities are missing), which were inclined backwards. The dorsal centra in the upper

Fig. 7.



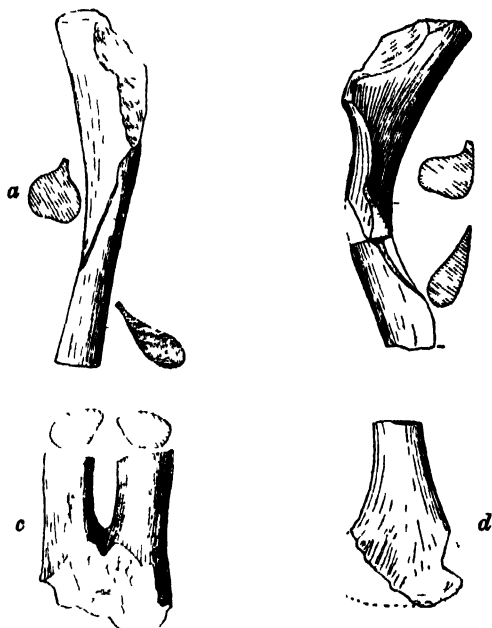
*Megalosaurus parkeri*. Lateral aspect of fragmentary right ilium, with a dorsal vertebra,  $\frac{1}{2}$  nat. size.

part are laterally slightly sinuous. The shape of the base of the transverse process resembles that of *Streptospondylus*. A third dorsal vertebra of the same size still adheres to the ilium (fig. 7).

The right ilium (fig. 7) is incomplete, as the anterior and

posterior extremities are missing, but it shows differences from *Megalosaurus bucklandi*. The angle between the processus proacetabularis and the lower edge of the anterior tip of the ilium is more obtuse than in the latter, and the angle between the processus postacetabularis and the posterior extremity is much more acute. The shape of the processes themselves, enclosing the acetabulum, is also

Fig. 8.



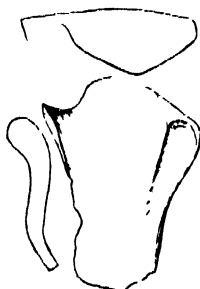
*Megalosaurus parkeri*. Pubis,  $\frac{1}{2}$  nat. size. *a*, lower aspect of proximal part of right pubis with transverse sections, a short part of the obturatorial margin visible; *b*, same of left bone longer part of obturatorial margin; *c*, ankylosed distal ends of both pubes showing posterior and right aspects, with transverse sections; *d*, lateral (left) aspect of distal end.

different from *Megalosaurus bucklandi*. The size of the ilium is big; the height from the processus proacetabularis to the upper edge measures 45 cm., the width of the acetabulum 20 cm., and its height 11 cm. The processus proacetabularis is 12 cm. long at the anterior side.

The right and the left pubes (fig. 8) are partly preserved. The proximal halves are there. The left one shows part of

the margin of the obturator foramen, 8 cm. long; in the right pubis, too, some part of it is preserved. The lower border of the obturator foramen is situated 18 cm. from the proximal extremity of the bone. About 10 cm. more distant, the narrow median lamella is already directed horizontally, though in the more proximal part it is directed

Fig. 9.



*Megalosaurus parkeri*. Proximal fragment of left ischium,  $\frac{1}{2}$  nat. size, with upper face and outline of anterior break.

downwards. The transverse diameter at this place is only 9 cm. Besides there is another piece which I take for the distal extremities of both pubes, concrescent at the distal ends and with part of the so-called "interpubis." It is shown best in fig. 8. The thick pubic shafts diverge slightly

Fig. 10.

prox.

dist.



*Megalosaurus parkeri*. Anterior aspect of right femur,  $\frac{1}{2}$  nat. size.

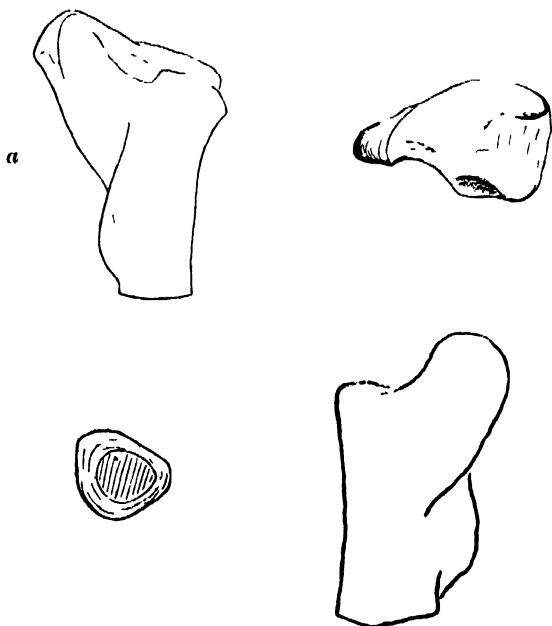
distally they are ankylosed and are very much thickened in the antero-posterior direction, and together form a thick hook-like process directed backwards, of which the greatest part is broken off.

Of the left (fig. 9) and right ischia there are preserved proximal parts with the articular face for the ilium and part

of the subacetabular notch, which differs from *Megalosaurus bucklandi* at least by the presence of a lateral longitudinal ridge.

The right femur (fig. 10), whose proximal end is much corroded, has a length of 80 cm. The lower end of the trochanter quartus is situated 36 cm. distant from the caput. The trochanter major and the distal condyli are large, and the shaft in its distal half is slightly curved.

Fig. 11.



*Megalosaurus parkeri*. Proximal end of left tibia,  $\frac{1}{2}$  nat. size. *a*, lateral aspect showing cnemial crest and crista lateralis; *b*, upper aspect; *c*, transverse break below; *d*, anterior aspect.

The proximal part of left tibia (fig. 11) is well preserved. The cnemial crest projects much forwards and slightly upwards and laterally. The diameter of the head from here to the lateral condylus is 20 cm., and the greatest transverse diameter of the laterally declivous articular face is 18 cm. Below the head of the tibia there is a crista lateralis more than 10 cm. long, whose distal end is 25 cm. below the articular face.



These remains indicate an animal, probably belonging to *Megalosaurus*, different from the species described above, and I propose to name it *Megalosaurus parkeri*, sp. n.

This species is characterized by the high dorsal spines, the shape of the ilium, the narrow pubis with large foramen obturatorium and distal "interpubis," the ischium with lateral longitudinal ridge near the articular face, and the characteristic shape of the head of the tibia.

(4) *Megalosaurus dunkeri*, Lydekker (Dames).

This specimen, belonging to the British Museum, was found in the quarry of Hollington near Hastings, Sussex, in the Wadhurst Clay of the Lower Wealden. It consists of two teeth, one incomplete opisthocœlous anterior dorsal vertebra, one incomplete middle caudal vertebra, the incomplete right scapula, crushed right tibia, and metatarsals II. and IV. of the left foot.

The name given by Dames (1) was proposed for an isolated tooth, but I refer here to skeletal remains which Lydekker from arguments of probability assigns to the same species, of which the teeth are common in the English Wealden. The horizon to which the remains belong is the Lower Wealden near Hastings; the type-tooth also comes from the Lower Wealden of North-western Germany. This rather large species is specially characterized by the difference in size of metatarsals II. and IV. (Lydekker, 12, fig. 4), which, indeed, is very striking. Metatarsals II. and IV. possess sharp edges in front towards metatarsal III. The distal extremity of metatarsal IV. by its shape resembles that of *Megalosaurus bucklandi*, but metatarsal II. is much more slender there. So the foot is quite different from that of the species in the Middle Jurassic. A fairly well-preserved anterior dorsal vertebra is distinctly opisthocœlous (Lydekker, 11, p. 166; R. 604a, in the Brit. Mus.), like *Streptospondylus*.

Bones referred to this species by Lydekker are not rare. Probably most of the skeletal bones mentioned by Lydekker (11, p. 168) belong here.

There is another specimen from the Wealden of Battle, near Hastings, Sussex, consisting of three articulated middle dorsal vertebræ, with extremely high neural spines. If this—as seems to be the case—also belongs here, the species possesses enormously high neural spines in the dorsal vertebræ (Owen, 14, pl. xix.), corresponding to four vertebral lengths. *Megalosaurus parkeri* is already striking with

neural processes of two vertebral lengths ; but here, in fact, it is very remarkable for a Carnosaurian, and, if it were certain that such dorsal vertebræ belong to *Megalosaurus dunkeri*, it would be necessary to put it into a distinct genus, for which the name *Altispinax*, *gen. nov.*, might be reserved.

The type-specimen, a tooth, in the University Museum at Marburg, Germany, was found in the Lower Wealden at Obernkirchen, on the Dneister, near Hanover. It is large, falciform, with a cutting and serrated longitudinal edge at the posterior side and a thickened obtuse anterior border. This tooth has also been described and figured by Koken ("Die Dinosaurier, Crocodiliden und Sauropterygier des nord-deutschen Wealden," *Pal. Abh.* ii. 5, 1887, pp. 319-320, Tf. ii, 2). The teeth figured by Owen (15, pl. xi. pp. 3-4 and 8-11) cannot be considered as being convincingly identical, but the possibility of their belonging to the same species may be left open. The type-material of the specimen from Hollington Quarry (see above) ought to be better investigated for this purpose, because these teeth and skeletal remains were found together (according to Lydekker, they belong to the same individual). If these teeth should be found to be certainly identical with the type-tooth, this specimen should be taken as forming the basis for our knowledge of the species.

(5) *Megalosaurus superbus* (Sauvage).

This species is from the Middle Cretaceous of Louppy and Grandpré in the north of France (Meuse and Ardennes). The type-specimen, from the Bois de la Panthière near Louppy-le-Château, Dép. Meuse, is of Gault age (Albian with *Ammonites milletianus* and *mammillaris*). It comprises two teeth, a fragment of lower jaw, several dorsal vertebral centra, part of a sacrum, several caudal vertebræ, ribs, an articulated part of a manus, femur, tibia, (?) calcaneum, metatarsals, and phalanges. These bones were first mentioned in 1875, 1876, and 1882 (*cf.* Barrois, "Les reptiles du terrain crétacé du nord-est du bassin de Paris," *Bull. scient., hist. et lit. du Nord*, vi. 1875 ; H. E. Sauvage, "La présence du type Dinosaurien dans le Gault du Nord de la France," *Bull. Soc. géol. France*, (3) iv. 1876, pp. 439-442 ; *id.*, "Sur les Reptiles trouvés dans le Gault de l'Est de la France," *C.-R. Acad. Sci. Paris*, 94.1 mai 1882, p. 1265). The other find, close to the first, was in the same horizon at Grandpré in the Forest of the Ardennes—it includes two teeth and two metatarsals (figured in 17, pl. iii. fig. 2, from the description on p. 19). The teeth resemble *Megalosaurus*, but most

of the bones differ from that genus. The size is rather small (length of femur 50 cm.).

The shortly described lower jaw (posterior part) has not been figured (Sauvage, 17, p. 9), and so is rather difficult to appreciate. The vertebral centra of the back (Sauvage, "De la présence du type Dinosaurien dans le Gault du Nord de la France," Bull. Soc. géol. France, (3) iv. 1876, pl. xi. fig. 2; 17, p. 11) are short and high, and so are distinctly different from *Megalosaurus*, especially *M. bucklandi*. They are  $5\frac{1}{2}$ – $6\frac{1}{2}$  cm. long. A caudal vertebra is described as "elongated" ( $7\frac{1}{2}$  cm.); at the position of the transverse process it exhibits a sharp and long horizontal edge, like Seeley's *Eucercosaurus tanyspondylus* (Quart. Journ. Geol. Soc. London, xxxv. 1879, p. 613) from the Middle Cretaceous of Cambridge. In *Megalosaurus*, on the contrary, the caudal vertebræ become shorter posteriorly and have another shape.

The right femur (17, pp. 15–16, pl. i. fig. 1) differs much from *Megalosaurus* by the medially bent collum femoris, between the trochanter major and the caput, and also by the fact that the fibular condylus is more developed than the other one, which is the reverse in *Megalosaurus*. The distal part of the shaft is less curved than the proximal half; this too is the reverse of *Megalosaurus*. Hence the hind leg must have been straighter than in *Megalosaurus*. The same is shown by the position of the articular face of the caput femoris.

Of the right tibia there are preserved a proximal (17, pl. iii. fig. 1) and a distal (17, pl. iv. fig. 1) part, both in good state. The crista lateralis is situated very high, but only its uppermost beginning is still shown. The cnemial crest projects much and the condyli of the head of the tibia lie close together (13 to 7 cm. diameter of the articular face). The distal end, which is only shown from its posterior side, is much like *Megalosaurus*.

There is also a proximal end of a right fibula (17, pl. i. fig. 2). From Grandpré the extremity of a bone is figured in pl. iii. fig. 2, which I take for the distal end of a fibula; not far from the articular end it is very narrow.

An element figured in 17, pl. ii. fig. 2, probably is a calcaneum. It is narrower and more rounded below than that of *Streptospondylus*.

Of the metatarsus is preserved a very nice left metatarsal II. (17, pl. i. fig. 3) of almost half the length of the femur (22 cm.); it is straight and strongly built. Also a phalange

(pl. iv. fig. 4) of the fourth toe is described and figured, further (pl. iii. fig. 3) the first phalange of the first toe.

The element, explained by Sauvage as a clavicle (17, pl. iv. fig. 2) is probably the articular end of a scapula.

There is also part of a manus with very slender phalanges (17, pl. ii. fig. 1). The thumb has a very short first phalange, but only a moderately-sized claw. The second digit has a claw of the same size as the first one, and the second phalange is very slender and elongate. It is not quite clear what the figure shows of the next finger on the same piece of rock. Pl. iv. fig. 1 probably is also a phalange of the manus, as it seems a first one. Pl. v. fig. 1 is, I think, quite correctly explained as "a lateral metacarpal," the fifth probably, and indeed it is much like metacarpal V. of the Triassic Plateosauridæ and *Megalosaurus poikilopleuron* from the Middle Dogger of Normandy, but it would be very surprising if such an element still existed here. I have never seen a fourth metacarpal become so stout. Besides, two fragmentary metacarpals are mentioned of 12 cm. length, and with triangular, slightly convex, articular faces; these possibly are rather the distal extremities of the bones of the lower arm. The ulnar part of the manus remains uncertain. The small size of the claws is unusual.

All these remains were found close together at Louppy, so they probably all belong to the same individual (17, p. 15). Besides this, however, the distal part of a different and nearly double-sized femur has been found there, belonging to quite a different unknown Carnosaurian (17, p. 16).

"*Megalosaurus*" *superbus*, Sauvage, is certainly not *Megalosaurus*. On account of the characters of the femur I propose to call this genus *Erectopus*, gen. nov.

(6) "*Thecospondylus*" *daviesi* (Seeley).

This is half a cervical vertebra from the Wealden of Brook, in the Isle of Wight. Seeley proposed to connect it with the doubtful genus *Thecospondylus* from the Hastings Sands of the Wealden, and he named the species (19) *daviesi*. Seeley established the genus *Thecospondylus* ("On *Thecospondylus horneri*, a new Dinosaur from the Hastings Sand, indicated by the Sacrum and the Neural Canal of the Sacral Region," Quart. Journ. Geol. Soc. London, xxxviii. 1882, pp. 457-460, pl. xix.) only on a natural cast of the sacral region and fragments of bone. The pneumaticity and the size of this half cervical vertebra made Seeley ascribe it to

the latter genus, but as a new species. It is evident that one cannot rely upon such a conclusion. It is not yet fixed to what this sacral neural cast belongs, and I am not convinced that it is of a Cœlurosaurian. It might rather belong to an Orthopod, so I leave it out. But the cervical vertebra is certainly that of a Cœlurid. It differs from *Cœlurus* by the small præzygapophyses situated lower down; it has twice the size of the latter. So a second Cœlurid genus is represented, and I propose to name it *Thecocœlurus*, gen. nov., suggesting the two genera to which the cervical vertebra were ascribed.

(7) *Aristosuchus pusillus* (Owen).

These bones were found in the Wealden of Brook, Isle of Wight. They are five articulated dorsal and sacral vertebræ, two single dorsals and two caudals, a pubis, and one claw of the manus.

*Aristosuchus pusillus* was rightly interpreted by Seeley (18). The rod-like pubes, with the enormous hook-like "interpubis" suggesting only a just slightly adherent suture at the ventral side, are suggestive not a little of *Cœlurus* (Gilmore, 2, pl. xxxiv. fig. 5) and of *Compsognathus* (Huene, 3, p. 337, fig. 315). Seeley's figure (18, pl. xiv.) shows best a vestigial trace of the medially extending lamella, represented almost an edge at the medial side of the left pubis.

Owen's excellent figures (16) of the anterior dorsal vertebra (fig. 1), 21 mm. in length, show the formation of the diapophysis without supporting buttresses as in *Cœlurus*, which is unknown in Carnosauria. The hour-glass-like shape of the centrum is much like that of *Ceratosaurus*.

Especially interesting is the series of five articulated vertebræ, taken by Owen as two sacral and two lumbar vertebræ. Their lengths are from front backwards: 25, 29, 24, 23, 21 mm. There can be no doubt that the two last ones are sacrals. It seems to me, however, that the three preceding vertebræ were also in contact with the anterior tips of the ilia, only in a less fixed way. The transverse process of the middle one of the five vertebræ still stands at the same height as the following sacral rib, and it is much thickened anteriorly and posteriorly at its distal extremity. It is also evident that the centrum of this vertebra had a distinctly saddle-shaped anterior articular face, exactly as in the caudally succeeding vertebræ, but in contrast to the orally following ones. Also the transverse process of the vertebra in front of this last one, already rising slightly higher, is still broadened in the same manner (the posterior distal

angle seems to be damaged). The centrum of the most anterior one of these vertebræ is higher and shorter, the transverse process still rises higher than the former one and is directed distinctly much backwards, and is also distally broadened. In the two posterior vertebræ, the sacral rib in its essential part is inserted on the centrum, in the preceding one of the five vertebræ this is the case, too, but in a lesser degree; the second vertebra (of the 5th from in front) exhibits a rough projection about on the centroneural suture, which may correspond with the parapophysial part in the other sacral ribs; in the anterior one of these vertebræ there is still only a projection resembling a buttress below the transverse process. In these vertebræ the two last ones are true sacrals, the two anteriorly following ones I take as lumbo-sacral vertebræ; that means that they probably correspond to the 12th and 13th dorsals, but they seem to have been, as in *Ceratosaurus* (Gilmore, 2, pl. xxi.), still between the probably very long anterior tips of the ilia and in contact with them. Probably only the most anterior one of these vertebræ (it would be the 11th dorsal) had free ribs. The shape of this transverse process even at its distal end is much like that of the figured (16) anterior dorsal vertebra.

From the preceding description it seems that the two lumbo-sacrals are situated in front of the probably five sacrals (of which only the two most anterior ones are preserved). *Ornithomimus* (*Struthiomimus*, Osborn, 13, pl. xxvi. fig. 1) has in front of the firmly coalesced true sacral vertebræ (which are followed by one caudo-sacral) sacro-lumbar vertebræ corresponding to the 12th and 13th dorsal, while the preceding first free and rib-bearing vertebra has its transverse process much directed forward. This is not so in *Ceratosaurus* with the first free and rib-bearing vertebra in front of the ilium (Gilmore, 2, pl. xxx.), but its transverse process is directed backward, and the rib is covered by the outmost tip of the ilium. This is quite unusual in *Ceratosaurus*, because, so far as I know, besides this in all other forms the last rib-bearing vertebra directs its transverse processes anteriorly to avoid colliding with the ilium. In this point, however, *Aristosuchus* is like *Ceratosaurus*. Here also the broad last dorsal vertebræ, quite as in *Ceratosaurus* and *Ornithomimus*, have become sacro-lumbars. From this also a similar and anteriorly much elongated ilium may be inferred. If it were known whether three or five vertebræ compose the firmly ankylosed sacrum, one would be able to judge better of the relation between *Aristosuchus* and *Ceratosaurus*, for the latter has five firmly ankylosed sacral

vertebræ (besides the lumbo-sacrales) and behind them one caudo-sacral.

The distal caudal vertebra, 28 mm. in length, figured by Owen (16, pl. i. figs. 5-8) is not so characteristic that it helps a decision.

More important than this vertebra is a claw (figs. 12-13), which, by its size (34 mm., making almost two vertebral lengths), sharp curvature, symmetry, and narrowness, clearly belongs to the manus. Such big hands are not usual in Carnosauria, but in Cœlurosauria.

Hence I regard *Aristosuchus* as a Cœlurosaurian.

#### LITERATURE.

- (1) DAMES, W. "*Megalosaurus Dunkeri*." Sitz. ber. Ges. naturf. Freunde, Berlin, 1884, p. 187.
- (2) GILMORE, CH. W. "Osteology of the Carnivorous Dinosauria in the United States National Museum, with special reference to the Genera *Antrodemus* (*Allosaurus*) and *Ceratosaurus*." U.S. Nat. Mus. Bull. cx. 1920, pp. 1-159, 76 figs., 36 pls.
- (3) HUENE, F. v. "Die Dinosaurier der europäischen Triasformation." Geol. u. Pal. Abh. Supplem. Bd. i. 1907-08.
- (4) —. "Ueber die Zweistämmigkeit der Dinosaurier mit Beiträgen zur Kenntnis einiger Schädel." N. Jahrb. f. Min. etc. Beil. Bd. xxxvii. 1914, p. 577.
- (5) —. "Fossilium Catalogus: Saurischia et Ornithischia," i. p. 4, 1914.
- (6) —. "Beiträge zur Geschichte der Archosaurier." Geol. u. Pal. Abh. xiii. p. 1, 1914.
- (7) —. "Das natürliche System der Saurischia." Centralbl. f. Min. etc. 1914, p. 154.
- (8) —. "The Dinosauria not a Natural Order." Amer. Journ. Sci. xxxviii. 1914, p. 145.
- (9) —. "Saurischia and Ornithischia." Geol. Mag. 1914, p. 444.
- (10) —. "Bemerkungen zur Systematik und Stammesgeschichte einiger Reptilien." Ztschr. f. induct. Abstammungs- und Vererbungslehre, xxii. pt. 3, 1920, p. 209.
- (11) LYDEKKER, R. "Catalogue of the Fossil Reptilia and Amphibia in the British Museum." Pt. I. 1888.
- (12) —. "Metatarsus of *Megalosaurus* from the Wadhurst Clay." Quart. Journ. Geol. Soc. London, xvi. 1890, pp. 45-47, fig. 4.
- (13) OSBORN, H. F. "Skeletal Adaptations of *Ornitholestes*, *Struthiomimus*, *Tyrannosaurus*." Bull. Amer. Mus. Nat. Hist. N.Y. xxxv. 1917, pp. 733-771, 21 figs., pls. xxiv.-xxvii.
- (14) OWEN, R. "Monograph of the Fossil Reptilia of the Wealden Formations. Pt. IV. Dinosauria." Palæontograph. Soc. 1854, pp. 1-54, pls. i.-xix.
- (15) —. "Monograph of the Fossil Reptilia and Amphibia of the Wealden Formations. Pt. III. Dinosauria (*Megalosaurus*)." Palæontograph. Soc. 1857, pp. 1-26, pls. i.-xii.
- (16) —. "Monograph of the Fossil Reptilia of the Wealden and Purbeck Formations. Supplement Nr. VII. Crocodilia (*Poikilopleuron*) and Dinosauria (*Chondrosteosaurus*)." Palæontograph. Soc. 1876, pp. 1-7, pls. i.-v.

- (17) SAUVAGE, H. F. "Recherches sur les reptiles trouvés dans le Gault de l'Est du Bassin de Paris." *Mém. Soc. géol. France*, (3) ii. 1882, Nr. 4, pp. 1-41, pls. xxix.-xxxii.
- (18) SEKLEY, H. G. "On *Aristosuchus pusillus* (Owen), being further Notes on the Fossils described by Sir Richard Owen as *Poikilopleuron pusillus*, Owen." *Quart. Journ. Geol. Soc. London*, xliii. 1887, pp. 221-228, pls. xii.-xiv.
- (19) —. "On *Thecospondylus daviesi* (Seeley), with some Remarks on the Classification of the Dinosauria." *Quart. Journ. Geol. Soc. London*, xliv. 1888, pp. 79-87, 5 figs.
- (20) WOODWARD, A. S. "On a Skull of *Megalosaurus* from the Great Oolite of Minchinhampton (Gloucestershire)." *Quart. Journ. Geol. Soc. London*, lxvi. 1910, pp. 111-114, pl. xiii.

LXI.—*Exotic Muscaridæ (Diptera)*.—XVIII. By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.

### Family *Muscidæ*.

#### Subfamily *MUSCINÆ*.

#### *Musca (Biomyia) planiceps*, Wied.

In the last part of this series of papers I described a species which I assumed to be this one. After writing the MS., I tried to ascertain whether the type-specimen of *planiceps* had a certain character, and after some time did discover that this character, the presence of a distinct bristle near middle of the posterior surface of fore tibiæ, was found in the type. Dr. Bezzi informs me that Dr. Lundbeck transmitted this information to him after I had asked the former to discover for me if this was a fact. I have never seen any specimen of *planiceps* from Java, from which island it was described, but have seen Indian specimens, and know from information received from Mr. J. E. Collin that the type of *cingalaisina*, Bigot, has the same character, which is unique in the genus so far as I am aware at present. Thus I can corroborate Dr. Patton's statement as to synonymy.

The correct name of the species described in my paper as *planiceps* is not certainly known to me at this time, though it probably is already described.

### Family *Calliphoridae*.

#### Subfamily *CALLIPHORINÆ*.

In Part XVI. of this series of papers I erected the genus *Obscuria* with one species, *spinicosta*, Malloch, as its representative. Since writing that paper, I have been able to



obtain from Dr. M. Bezzi a specimen of *Paratricyclea stabulans*, Bezzi, and now present a summary of the characters of *Obscuria* and its nearest relatives known to me.

Villeneuve erected the genus *Paratricyclea* with *stabulans*, Bezzi, as genotype. Several other species have been included in the genus. In all of the species except *dubiosa*, Villeneuve, there are at least one pair of presutural and one pair of prescutellar acrostichals present. In *Obscuria spinicosta* these are lacking, and it therefore appears possible that *dubiosa* is referable to *Obscuria*. In *Obscuria* the genotype has the central portion of the propleura almost bare, and there are but two well-developed bristles on the presutural area bounded by the dorso-central, humeral, and notopleural bristles. This area I refer to later in this paper as the *presutural area*. In all the species of *Paratricyclea* I have before me the central portion of the propleura is rather conspicuously haired, and there are almost invariably at least three well-developed bristles on the afore-mentioned presutural area. A character possessed in common by *Obscuria* and *Paratricyclea* is that of erect, rather long, fine hairs on the supraspiracular convexity of the metathorax. Normally in this family this convexity is downy, rarely pubescent, and sometimes almost bare, but in these two genera and in *Hypopygiopsis*, Townsend, *Phumonia*, R.-D., and *Hemipyrellia*, Townsend, there are quite conspicuous erect hairs. A very careful comparison of the African species available to me proves that several of those which I identify as having been referred to *Paratricyclea* are more closely related to *Caiusa*, Surcouf, than they are to typical *Paratricyclea*. I append a synoptic key for the separation of the three genera that I accept as valid :—

1. Only two well-developed bristles on the presutural area; neither presutural nor prescutellar acrostichals present ..... *Obscuria*, Malloch.  
 At least three bristles on the presutural area, the inner one just in front of suture sometimes very short; at least one pair of presutural and prescutellar acrostichals present ..... 2.
2. The very narrow suprasquamal ridge with short, fine, but distinct hairs on almost its entire length; four bristles on presutural area; face sometimes with two fine hairs near lower margin in centre ..... *Phumonia*, R.-D.  
 The suprasquamal ridge without any trace of hairs; three or four bristles on the presutural area ..... *Paratricyclea*, Villen.

Genus *PARATRICYCLEA*, Villeneuve.

If we are to accept the rule in use by American entomologists that a generic name must be coupled with that of its cited genotype irrespective of whether the latter were correctly or incorrectly identified by the describer of the genus, we must place *Paratricyclea* as a synonym of *Apollenia*. Bezzi cited as the genotype of his genus the species he had determined as *nudiuscula*, Bigot, but what he had before him at the time was *tristis*, Bigot, which is generically distinct from *nudiuscula* and is, in fact, generically indistinguishable from *Strongyloneura*, Bigot. Villeneuve retained *Apollenia* for *tristis* and erected *Paratricyclea* for *stabulans* and other African species, including *nudiuscula*. Subsequently he placed *tristis* in *Thelychæta*, Brauer & Bergenstamm.

I have been impelled lately to make a very careful study of a number of species belonging to *Paratricyclea* from Africa, and, having on hand a number of specimens of closely related groups, including *Caiusa*, from the Orient, I was struck by the fact that the insects were very similar in generic characters. In fact, it appears to me impossible to grant to the various segregates of this group of species more than subgeneric status. I realize that extremists may either lump all of these under one genus or conversely consider each group entitled to full generic status. Without a larger representation of species I do not care to commit myself to the latter course, and the former does not commend itself to me.

I present below a diagnosis of the species before me, citing the principal characters for the recognition of these and the groups to which they belong. It will be evident to specialists that the groups are closely related, and I have had to make use of several previously unused characters for the separation of some of them:—

- |   |                                  |
|---|----------------------------------|
| 1. At most only three bristles on the presutural area, the weak outer posthumeral one absent; sternopleurals 2+1; parafacials almost bare; postsutural dorso-centrals three pairs ..... | [Bezzi.                          |
| At least four bristles on the presutural area, or if there are but three present the sternopleural bristles are 1+1, or the parafacials are very conspicuously haired .....             | <i>Paratricyclea stabulans</i> , |
| 2. Parafacials rather copiously haired, the hairs setulose; postsutural dorso-centrals four pairs; sterno-pleurals 2+1 .....  | [cula, Big.                      |
| Parafacials bare or very sparsely haired on upper part. ....  | <i>Paratricyclea nudius-</i>     |
| 3.  |                                  |

3. Sterno-pleurals 1+1; three bristles on pre-sutural area; lower stigmal bristle present ..... [Bezzi.  
*Paratricyclea bicolor*,  
Sterno-pleurals 1+1; four bristles on pre-sutural area; lower stigmal bristle absent ..... Subgenus *Cuiusa*, Surc.  
Sterno-pleurals 2+1; lower stigmal bristle present ..... 4.  
4. Post-sutural dorso-centrals four pairs ..... 5.  
Post-sutural dorso-centrals three pairs ..... 8.  
5. No hairs at junction of humeral cross-vein and subcosta on underside of wing; thorax black-blue ..... [Villen.  
*Paratricyclea cærulea*,  
A few hairs on underside of wing at junction of humeral cross-vein and subcosta ..... 6.  
6. Thorax and abdomen brilliant metallic greenish blue; legs black; calyptræ white, lower one slightly darkened on disc in male ..... [Lucilia, Villen.  
*Paratricyclea pseudo-*  
Thorax largely brownish testaceous; legs dusky yellowish testaceous; calyptræ yellowish ..... 7.  
7. Both thorax and abdomen dusky brownish testaceous, with slight traces of bluish reflections ..... [Villen.  
*Paratricyclea imitans*,  
Thorax brownish testaceous, abdomen blue-green ..... [*ventris*, nov.  
*P. imitans*, var. *cærulei-*  
8. Face with two fine hairs in centre of lower part; eyes distinctly pubescent; black species, the thorax slightly purplish, abdomen metallic greenish black; hairs and bristles longer than usual on head, thorax, and abdomen ..... Subgenus *Phumosella*, nov.,  
[genotype *longiseta*, sp. n.  
Face without central hairs; eyes bare; not entirely black species ..... [*sis*, Villen.  
*Paratricyclea gambien-*

*Paratricyclea stabulans*, Bezzi.

Besides the male of this species received from Dr. Bezzi I have three females and two males, three from Kenya Colony, one from west of Mt. Kenya, and one from Entebbe, Uganda. I can detect no outstanding differences between these and a female specimen named *parva*, Karsch, by Bezzi, in the United States National Museum. Villeneuve's species *consors* is also very similar, judging from his description, but I have no specimens available for comparison.

The prealar bristle is practically absent in the males, present but weak in females; the post-sutural dorso-centrals, three pairs; legs grey-black, with yellowish tibiae in males, most of femora and all of tibiae yellowish in females. In distinguishing *consors* from *stabulans*, Villeneuve cites as

characters the presence of lateral discal bristles on the abdomen in the latter and their absence in the former, the longer tarsal claws of the male in *stabulans*, and the dilated fore tarsi of the female of the same species as against the simple fore tarsi in that sex of *consors*. In the females before me the fore tarsi are but slightly widened.

*Paratricyclea nudiuscula*, Bigot.

A shining black species, with slight æneous lustre, and rather distinct whitish dusting, the thorax quadrivittate, submedian vittæ linear, laterals wide, neither continuous, and black marks between all vittæ forming interrupted stripes; abdomen with a faint dark dorso-central vitta. Second antennal segment partly rufous; palpi brown; parafacials and cheeks brown, grey pruinulent. Legs black in male, the tibiæ more or less conspicuously reddish or yellowish, in female sometimes mostly rufous yellow, bases of femora and apices of tarsi blackened. Calyptreæ and halteres yellow.

The eyes have extremely short sparse hairs; parafacials broad, with stiff black hairs. Sometimes the anterior posthumeral bristle is very weak or even absent in male. The basal abdominal sternite is broad and almost transverse at apex, quite different from the narrowly rounded form of that of *stabulans*. Mid and hind femora of male copiously furnished with long bristles at bases, the tips of many of them slightly curled and hair-like.

Length 8–10 mm.

A large series of both sexes from Willow Grange, Natal (*R. C. Wroughton*).

*Paratricyclea cærulea*, Villeneuve.

A *Calliphora*-like species, with brownish head; thorax fuscous, with blue tinge on dorsum and sides, the mesonotum metallic greenish blue, with a fine dark dorso-central vitta, and checkerings of whitish pruinescence on dorsum; antennæ, palpi, and legs dark testaceous-yellow, the femora brownish apically below; wings, halteres, and calyptreæ rather noticeably brownish.

Parafacials bare. Thorax with 2+4 dorso-centrals, one or two presutural and three postsutural acrostichals; three postsutural intra-alars; sterno-pleurals 2+1. Abdomen short-ovate. Mid-tibia with an antero-ventral bristle in both

sexes. One or two fine hairs at junction of first and second veins below, none at humeral cross-vein below.

Length 7-9 mm.

Four specimens, 5 to 7 miles into Kenya Forest, near Luchi River, 9-10. ii. 1911 (T. J. Anderson).

*Paratricyclea pseudolucilia*, Villeneuve.

The colour of this species is a brilliant metallic blue-green, and in habitus, even to that of head, it closely assimilates species of *Lucilia* such as *cæsar*, Linné. Frons almost linear above; parafacials devoid of hairs, but densely silvery tomentose; vibrissæ but little above mouth-margin; cheek about one-sixth of the eye-height. Thorax with 2+4 dorso-centrals and 1+1 acrostichals; centre of postalar declivity haired; all fine hairs on insect black. Abdomen with slight white dusting on the incurved lateral portions of tergites; fourth tergite without strong discal bristles. Ventral median bristle present on mid-tibia. Some setulæ at humeral vein and base of second vein on underside of wing; venation normal.

Length 8 mm.

One male, Embu, Kenya Colony, 24. iii. 1914.

*Paratricyclea bicolor*, Bezzi.

A specimen which I take to be this species is brownish testaceous, the thorax more greyish and faintly vittate, the abdomen with traces of a dark dorso-central vitta and dark posterior margins to tergites. Orbits subfuscous. Frons almost linear above; face with a slight central carina which is impressed in centre; parafacials narrow; vibrissæ distinctly above mouth-margin and about as widely separated as either is from eye; cheek about one-fourth of the eye-height. Thorax with 2+3 dorso-centrals and 1+1 or 2 acrostichals; but three bristles on the presutural area; intra-alars behind suture 2; postalar declivity haired in centre; scutellum with ten bristles. Abdomen ovate; fourth tergite without discal bristles. Mid-tibia with median ventral bristle. One or two weak hairs at humeral vein below and sometimes also at base of second vein.

Length 8.5 mm.

One male, Ibadan, Nigeria, 3. vii. 1922.

*Paratricyclea imitans*, Villeneuve.

Differs from the preceding species in being darker in colour, more shining, and with traces of metallic blue or

coppery colour on thorax and abdomen. The facial carina is broader, there are four pairs of postsutural dorso-centrals and three pairs of postsutural intra-alars, and the setulæ at base of second wing-vein are more distinct.

Length 8-9.5 mm.

Three males from Kampala and Entebbe, Uganda (C. C. Gowdey).

*Paratricylea imitans*, var. *cæruleiventris*, nov.

Differs from the type-form in having the thorax more noticeably blue-tinged and the abdomen entirely metallic blue.

Length 9-9.5 mm.

Type, female, and three female paratypes, Kampala, Uganda (C. C. Gowdey).

I would have considered this merely the normal female of *imitans* were it not for the fact that Villeneuve makes no mention of the bright blue colour of the abdomen in his description of the species.

*Paratricylea gambiensis*, Villeneuve.

Two specimens, the male in poor condition, appear to belong to this species. They are brownish testaceous in colour, the abdomen with a rather pronounced dorso-central blackish vitta. Dorso-centrals 2+3.

Male, 5 to 7 miles into Kenya Forest, near Luchi River; female, Kenya Colony.

*Paratricylea (Phumosella) longiseta*, sp. n.

*Male*.—Black, shining, thorax slightly purplish behind, abdomen distinctly metallic greenish on dorsum. Face, parafacials, and cheeks brown, the parafacials with slight reflections, antennæ and palpi brown. Thorax when seen from behind with sides and two broad submedian vittæ whitish-dusted, the intervening three black vittæ shining, less distinct posteriorly. Abdomen rather faintly whitish-dusted, and with a faint dark dorso-central vitta basally. Legs black, tibiæ brownish. Wings smoky. Calyptreæ dark. Halteres dusky yellow.

Frons linear above; eyes sparsely pubescent; parafacials bare, wider than third antennal segment; face without a central carina, concave in profile, with two fine hairs in centre near lower margin as in *Phumosi*; vibrissal angles slightly produced, vibrissæ a little above mouth-margin; cheek over one-third as high as eye, the haired part closely

approaching eye, the hairs long and fine; proboscis slightly thickened. Dorso-centrals and most of the acrostichals very long, both arranged 2+5, the anterior presutural acrostichals fine and short; prealar long; scutellum with six long marginal and one pair of short pre-apical discal bristles; sterno-pleurals 2+1. Abdomen elongate-ovate, the hairs and bristles erect, both longer than usual. Legs with the usual bristles. Wings normal, costal spine distinct.

Length 6 mm.

*Type*, S.E. edge of Kenya Forest, 5000–6000 feet, 7.ii.1911 (*T. J. Anderson*).

This species shows its relationship to *Phumosia* in the pair of hairs on the face, but it lacks the hairs on the supra-ocular ridge, and is a more slenderly built species.

I erect for the reception of the species the subgenus *Phumosella*, based on the characters cited in the key and the above paragraph. Monobasic.

#### Subgenus *CAIUSA*, Surcouf.

This group has heretofore been considered as a distinct genus closely allied to *Phumosia*, R.-D., from which it was usually distinguished by the arrangement of the sterno-pleural bristles (1+1). Both these and *Paratricyclea* have been included in the so-called "Muscidæ Testacea," a rather heterogeneous group of no well-defined standing in the classification of Calliphoridae. I see no valid reason to grant more than subgeneric rank to *Caiusa*, and it is impossible without an examination of the type-specimens of several species described by Macquart and others to decide definitely the specific identities of those now on hand. I have tried to determine the species with the aid of available papers, but without clarifying the situation very much. I append some notes on the material before me.

It may be pertinent to remark that the hind coxæ in all the species have fine hairs above bases of the femora as in *Paratricyclea*.

#### *Paratricyclea (Caiusa) indica*, Surcouf.

This species is a fulvous-yellow in colour, with the disc of thorax blackened, and abdomen on dorsum except at base black with a blue lustre.

I have seen a male from Java which agrees entirely with Surcouf's description.

There is a male in the United States National Museum from Depok, Java, labelled "*Phumosi ferruginea*, Dol.,"

by Townsend, which differs from the above in having the third tergite concolorous with the basal two; the fourth has been removed.

*Paratricyclea (Caiusa) nigronitens*, Senior-White.

I have before me five female specimens which agree with the description of this species. I have no males which agree with these in colour, but suspect that colour alone is not a dependable character in this genus. Structurally they do not differ except sexually from *indica*, and may be merely dark females of that species. The dorsum of thorax, except the lateral margins, and dorsum of abdomen, except base, are black, with slight greyish dusting.

*Localities.* Singapore (type-locality), v. 1924; Kuala Lumpur, F.M.S., Sept.-Nov.; two specimens taken at light.

*Paratricyclea (Caiusa) testacea*, Senior-White.

A female from the Philippine Islands appears to belong to this species, the abdomen being testaceous-yellow, without conspicuous black markings. It has a few weak black hairs on lower surface of the humeral cross-vein of wing which are not present in any other species of the genus.

A male from Luzon agrees well with the female, having the dorsum of thorax blackened and the abdomen entirely yellow-testaceous, but there are no humeral hairs present.

The female was reared from masses of frogs' eggs, and it appears possible is the same as the species which Senior-White mentions with the same habit.

*Paratricyclea (Caiusa) sp.*

An Australian species, the exact identity of which is not known to me, is represented by a specimen of each sex before me. It is paler than the other species, having the thoracic dorsum without black marks. I hope to clear up the identity of this species later.

Surcouf mentions having seen a specimen of this genus from Queensland, which no doubt belonged to this species.

Genus *PHUMOSIA*, Robineau-Desvoidy.

I have before me five species which I consider are referable to this genus, three of them are Oriental and two African. I present a synopsis for their separation.

I accept as correct the synonymy given by authors who have examined the types of the old species, but it may be that there is some confusion, which only a very careful critical examination of the types will disclose.



*Key to Species of Phumosia.*

1. Thorax and abdomen deep metallic blue, fourth tergite metallic golden-green except at base, where it is blue; calyptre black, white at bases. (African species.) ..... *bipartita*, sp. n.  
 At least the thorax brownish or yellowish testaceous, the abdomen more or less bluish dorsally, but the fourth not golden-green; calyptre yellowish or brownish. .... 2.
2. Hind tibiæ without bristles on middle of postero-dorsal surface; two pairs of presutural and post-sutural dorso-centrals; no outstanding bristle at apex of subcostal vein ..... *incerta*, sp. n.  
 Hind tibia with one or more well-developed postero-dorsal bristles at, or near, middle .... 3.
3. Parafacial much wider at middle than third antennal segment, with a conspicuous brownish spot at base of antenna; frons distinctly widened in front; vibrissæ very distinctly above mouth-margin, the distance between them much less than distance of either from eye; thorax with four pairs of postsutural dorso-centrals; wing without costal cloud; hind tibia with three postero-dorsal and antero-dorsal bristles. (African species.) ..... *brunneescens*, sp. n.  
 Parafacial distinctly narrower at middle than third antennal segment, without a brown spot at bases of antennæ; vibrissæ but little above mouth-margin, the distance between them fully as great as distance of either from eye; thorax normally with but three pairs of postsutural dorso-centrals; wing with a conspicuous costal brown or fuscous cloud; hind tibia with one or two postero-dorsal and two antero-dorsal bristles ..... 4.
4. Costal infuscation beginning at apex of subcosta, the suffusion quite general, becoming less intense posteriorly; genal hairs black; hind tibia with one postero-dorsal bristle; usually an additional pair of weak acrostichals in front of the presutural pair ..... *abdominalis*, R.-D.  
 Costal infuscation beginning beyond the apex of first vein, the streak along costa much blacker than the rather weak posterior suffusion; genal hairs yellow; hind tibia with two postero-dorsal bristles; acrostichals 1+1, no weak anterior pair evident ..... *costata*, sp. n.

*Phumosia abdominalis*, Robineau-Desvoidy.

This is evidently the species identified as *abdominalis* by Surcouf, my specimens being from Mt. Maquiling, and his from Los Baños, both in the Philippines. The specimens agree with his figure and descriptions, but he makes no

mention of the postero-dorsal bristle on the hind tibia, a quite important character, though his figure appears to show the bristle present. The abdomen in all my specimens is yellowish at base, on sides, and also on apex of fourth visible tergite.

Length 9–11 mm.

Eight males, Mt. Maquiling, Luzon (*C. F. Baker*).

*Phumosia costata*, sp. n.

*Male and female*.—Differs from the preceding species as stated in the key. It also has the abdomen much paler, with very little indication of the bluish colour of the last species.

Length 11 mm.

*Type*, female, allotype, and two female paratypes, Mt. Maquiling, Luzon, Philippine Islands (*C. F. Baker*).

This species agrees with the figure given by Surcouf for *analis*, Macquart, but that does not show the postero-dorsal bristles on hind tibia, nor does the description given by Surcouf fit the present species in certain respects, such as the colour of the abdomen and the extension of the setulæ on base of third vein almost to the inner cross-vein. Macquart's species were described from Australia.

*Phumosia incerta*, sp. n.

*Male and female*.—Similar in general colour and structure to *abdominalis*, the wings more or less infuscated, or only tinged with brownish.

The thorax has one or two pairs of presutural acrostichals, and four pairs of postsutural dorso-centrals, only one of the eight specimens before me having three pairs, and this is apparently abnormal judging from the spacing of the bristles; there are invariably two pairs of strong prescutellar acrostichals present instead of one as in the preceding species. The hind tibia may have more than two short antero-dorsal bristles. Otherwise as *abdominalis*.

Length 9–11 mm.

*Type*, male, Selangor, Kuala Lumpur, F.M.S., 13. x. 1921. Allotype, Selangor, Kuala Kubu, ix. 1915. Paratypes, females, 3, Pahang, F.M.S. (*H. M. Pendlebury*); 1, Sumatra (*Karny*); and 1, Khow Sai Dow, Siam, 1000 feet (*W. L. Abbott*). The last specimen in the United States National Museum; type in British Museum.

There is a slight variation in the colour of the genal hairs in the series, in some specimens these are entirely black and

in others they are mostly yellowish. One specimen from Pahang has only three pairs of dorso-central bristles behind the suture, but the long space between the first and second pairs indicates that the second pair is missing and the specimen abnormal.

*Phumosia bipartita*, sp. n.

*Female*.—Head black, orbits, face, and cheeks whitish-dusted; antennæ black; palpi fuscous. Thorax metallic dark blue, with a faint purplish vitta along each series of dorso-centrals, the entire dorsum faintly white-dusted and slightly vittate, most noticeably so anteriorly. Abdomen violet-blue, fourth tergite golden green except narrowly at base, dorsum with whitish dusting, the incurved lateral margins of tergites quite noticeably white-dusted. Legs pitchy. Wings greyish hyaline. Calyptreæ black, white at bases. Halteres brownish yellow.

Frons about one-third of the head-width in front, narrowed behind, each orbit with one long and one short forwardly directed supraorbital; parafacial about as wide as third antennal segment, bare; face without the pair of hairs. Thorax with 2 or 3 + 4 dorso-centrals and 2 + 2 acrostichals; postsutural intra-alars 3. Hind tibiæ with two postero-dorsal and three antero-dorsal bristles. Wing normal, the setulæ present at humeral cross-vein and base of second veins below.

Length 10 mm.

*Type*, Embu, Kenya Colony, 18. xii. 1913.

The general habitus is robust, similar to that of the other species, but the much darker colour is distinctive.

*Phumosia brunnescens*, sp. n.

*Female*.—Head brownish testaceous, a dark brownish mark between each antenna and eye. Thorax brownish, with rather evident dorsal vittæ. Abdomen largely black with a bluish tinge, apices of tergites pale brownish testaceous. Wings greyish hyaline. Calyptreæ and halteres brownish yellow.

Frons as in preceding species; the pair of hairs on centre of face slightly above level of the approximated vibrissæ; some microscopic hairs on upper part of the broad parafacial; cheek nearly half as high as eye. Thorax with 2 + 4 dorso-centrals and 1 + 1 acrostichals. Hind tibia with two or three postero-dorsal and antero-dorsal bristles. Wing as in preceding species.

Length 9 mm.

*Type*, Kenya Colony, Solai Distr., Sonje Valley, 14.ix.1919  
(*T. J. Anderson*).

This species superficially resembles *Paratricyclea imitans*, Villeneuve.

#### Genus EUPHUMOSIA, nov.

This genus differs from *Phumosia* in having no erect fine hairs on the supraspiracular convexity, but two distinct bristles on the presutural area, no hairs on humeral cross-vein below, and the setulæ on base of third vein confined to the extreme base. There are but two postsutural intra-alars present.

*Genotype*: *Calliphora papua*, Guérin.

I have seen a specimen of the genotype, from which the above characters are drawn, in the United States National Museum. Synonyms of this species appear to be as follows: *eristaloides*, Walker, *variegata*, Bigot, and *papouana*, Bigot.

I interpolate the above data here, as this species has been referred to the genus *Phumosia*.

#### Genus HYPOPYGIOPSIS, Townsend.

This genus has much the same habitus and coloration as *Cynomyia*, R.-D. The latter is, however, furnished with erect hairs on a large part of the lower calyptra as in *Calliphora*, while in *Hypopygiopsis* there are no such hairs present. A very striking distinction between the latter and the other two genera consists of the presence on the supraspiracular convexity of fine erect hairs similar to those found in *Phumosia* and its allies already dealt with in this paper.

All the species of *Hypopygiopsis* known to me are brilliant metallic blue in colour, with the face, frons, palpi, and usually the antennæ and cheeks, bright orange-yellow. The arista is plumose to apex, the facial ridges are setulose on lower half, there are one or two forwardly directed supra-orbital bristles in the female, the thorax has both presutural and postsutural acrostichals and dorso-centrals, the prosternum, propleura, supraspiracular convexity, and a part of metanotum below lower calyptra are fine-haired, the supra-squamal ridge has two patches of setulæ as in the genus *Lucilla*, and the postalar declivity is haired in centre. Hind coxæ bare above bases of femora. Legs and wings as in *Cynomyia*, but the extreme base of radial vein is setulose below.

The genus is very similar to *Mesembrinella* in general

habitus, but in the latter the supraspiracular convexity is bare, as is also the centre of propleura. There is also a quite well-defined posterior flap to the metathoracic spiracle which is not evident in *Mesembrinella*.

I have before me males of three species which may be distinguished as in the key presented below.

*Key to Species of Hypopygiopsis.*

- |   |                           |
|---|---------------------------|
| 1. Fore tarsi with dense long black hairs on posterior side, similar to those on the tibiae, which are mostly longer than the segments on which they are situated; hairs on venter of abdomen all black . . . . . | <i>metallica</i> , Wulp.  |
| None of the tarsi with outstanding hairs as above; hairs on basal part of the venter of abdomen largely golden yellow . . . . .   | 2.                        |
| 2. Slender species; thorax with two pairs of postautural acrostichals . . . . .   | <i>splendens</i> , Towns. |
| Robust species; thorax with one pair of postautural acrostichals . . . . .  | <i>robusta</i> , sp. n.   |

*Hypopygiopsis splendens*, Townsend.

This is the genotype, of which I have seen the type-specimen in the United States National Museum. A female of the same species standing along with this bears a label in Bigot's handwriting with the name "*Calliphoravinosus*, Bigot." I can find no description of Bigot's species, and Townsend evidently assumed it was merely a manuscript name.

There is a striking, stout, chitinous process at apex of the male mid-tibia in all the species. The coxæ, trochanters, and basal two or three abdominal sternites are yellow in the male and female, and, in addition, the basal tergite and femora are mostly yellow in female. In the female the legs are normal in shape and lack the dense hairs of the male.

Length 12-13 mm.

*Locality.* Pahang, Kuala Teku, F.M.S., 5. & 7. xii. 1921 (*E. Seimund*).

Originally described from Siam.

*Hypopygiopsis robusta*, sp. n.

*Male.*—Metallic violet-blue. Differs from the foregoing species in having the basal tergite in male blue, not black, the venter and its hairs not so conspicuously yellow.

Much more robust than *splendens*, the legs stouter, the hind femora especially strong, and the hairs on femora and

tibiæ longer and denser. In other respects similar to *splendens*, except as noted in the key.

Length 18 mm., greatest width 8 mm.

*Type.* Sibolangit, Dutch East Indies, ix. 1920.

*Hypopygiopsis metallica*, van der Wulp.

This species is also metallic blue, but the antennæ are darker, the legs are nowhere yellow, nor is the venter. Only the fore tarsi are present in the male before me, so I cannot state if the others are fringed, nor can I say if the mid-tibia has a spur because the mid and hind tibiæ are missing.

Length 15 mm.

Originally described from the Dutch East Indies. I have one male from the Federated Malay States.

Genus *LUCILIA*, Robineau-Desvoidy.

This genus contains a large number of very closely allied species of similar appearance, many of which are of great economic importance throughout their range, in some cases of cosmopolitan extent; but, owing to a lack of knowledge of the differentiating characters of the species, published records of many of them are not entirely reliable. During the course of my work on calyptrate Diptera I have had many species of the genus submitted to me, and have found it next to impossible to identify them definitely with descriptions of the older authors. I have, however, made a careful study of the species, and submit in this paper some data on the characters which I consider to be of use in grouping them. I do this because in the event of anyone making an examination of the types of already described species a knowledge of these characters is most essential to reliable interpretation of these, and it is impossible for me to undertake the task of type-examination personally.

All species of the genus known to me have hairs on the centre of propleura, sides of prosternum, centre of postalar declivity, both extremities of the suprasquamal ridge, immediately below lower calyptra, and on at least the sides of the ventral surface of scutellum. The third wing-vein is setulose at base both above and below, the radius is bare on posterior side at base, and the fourth vein is quite angularly bent forward at or near middle of its apical section. Lower calyptra bare on disc above.

There are at least four well-defined segregates of the genus, three of which have already been distinguished by

names, *Lucilia*, R.-D., with *cæsar*, Linné, as genotype; *Phenicia*, R.-D., with *sericata*, Meigen, as genotype; and *Hemipyrellia*, Townsend, with *currei*, Townsend, as genotype. Coquillett cited *Somomya*, Rondani, as a synonym, but that genus is quite distinct and the name has priority over *Hemilucilia*, B. & B., the two having the same genotype, *segmentaria*, Fabricius.

The four segregates of *Lucilia* above referred to, which may be considered as subgenera, can be separated as indicated in the following synopsis.

#### Key to Subgenera of *Lucilia*.

- |  |                                |
|--|--------------------------------|
| 1. Supraspiracular convexity of metathorax with long erect fine hairs . . . . .                        | <i>Hemipyrellia</i> , Towns.   |
| Supraspiracular convexity of metathorax downy, without erect hairs . . . . .                           | 2.                             |
| 2. Base of radial vein setulose below . . . . .  | 3.                             |
| Base of radial vein bare below . . . . .   | <i>Phenicia</i> , R.-D.        |
| 3. Parafacials setulose on upper half to well below level of apex of second antennal segment . . . . . | <i>Luciliella</i> , subgen. n. |
| Parafacials bare . . . . .   | <i>Lucilia</i> , R.-D.         |

#### Subgenus *HEMIPYRELLA*, Townsend.

This subgenus contains at least four species, one African and three Oriental, all of which have apparently been described.

The hind coxæ in all the species have one or two fine hairs at apices above the bases of femora, the parafacials are bare, and the face rarely bears hairs in the centre in any species known to me.

Patton records *pulchra*, Wiedemann, as viviparous. The habits of others are not known.

I present below a key for the identification of the four species known to me. It is possible that the names here used may not prove final, but in the cases of *pulchra* and *currei* they are positive identifications. The other two require confirmation. I have sunk *phellia*, Walker, as synonymous with *pulchra*, Wiedemann, on the basis of information as to the presence of erect hairs on the supraspiracular convexity, furnished at my request by Mr. F. W. Edwards of the British Museum from an examination of Walker's type. I have examined the type-specimen of *currei*, Townsend, in the U.S. National Museum.

#### Key to Species of *Hemipyrellia*.

1. Third antennal segment bright orange-coloured; abdomen without dark apical fasciæ on any of the tergites. (Oriental.) *pulchra*, Wied.

- Antennæ black or brown, third segment only yellowish in small part below, or not at all; abdomen with a dark blue fascia at apex of each tergite except fourth visible.
2. Males ..... 2.
  - Females ..... 3.
  3. Eyes separated by less than width of third antennal segment; extreme lateral incurved margins of tergites and apical half of second sternite with long dense black bristles; blue species. (Oriental.) ..... 5.
  - Eyes separated by much more than the width of third antennal segment. .... 4.
  4. Extreme lateral incurved margins of basal tergites of abdomen without long dense bristles; golden-green species. (Oriental.) ..... *cyaneomarginata*, Macq.
  - Extreme lateral incurved margins of basal tergites of abdomen with long dense bristles; blue or greenish-blue species. (African.) ..... *currei*, Towns.
  5. Fourth abdominal tergite very noticeably white-dusted ..... *currei*, Towns.
  - Fourth abdominal tergite without noticeable white dusting ..... 6.
  6. Dark blue species ..... *? fortunata*, Walk.
  - Blue-green or golden species ..... *cyaneomarginata*, Macq.

*Lucilia (Hemipyrellia) pulchra*, Wiedemann.

The bright orange-coloured antennæ and lack of dark apical tergal fasciæ on abdomen distinguish this species readily from its allies. Synonyms are *ruficornis*, Macquart, and *phellia*, Walker.

*Lucilia (Hemipyrellia) ?fortunata*, Walker.

I accept this as the name for a very common species occurring in the Philippines and Java. Possibly it may be described under other, and probably earlier, names, and may be much more widely distributed than yet known to me.

*Lucilia (Hemipyrellia) cyaneomarginata*, Macquart.

This name is used here for a golden-green species with dark blue apices to the abdominal tergites, and may not be correctly applied; an examination of Macquart's type is essential to determine if the identification is correct.

Apparently a common species in the Philippines, Straits Settlements, and Federated Malay States.

*Lucilia (Hemipyrellia) currei*, Townsend.

An African species, occurring in Liberia, Nigeria, and the  
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Gold Coast. I have before me females of apparently the same species from Durban, Natal.

Subgenus *PHENICIA*, Robineau-Desvoidy.

I am not in a position to state how many species are referable to this subgenus, of which *sericata* is the genotype, but *argyrocephala*, Macquart, belongs here. This last species was recently redescribed as *pallescent* by Shannon, his material being from North America.

Subgenus *LUCILIA*, Robineau-Desvoidy.

In this subgenus the face usually has some minute hairs present on its lower half at least; these are rarely evident in the other subgenera. The hypopleura is haired on its upper margin in front of the spiracle.

I have seen *cæsar*, Linné, *metilia*, Walker, and *inducta*, Walker, of the known species. There are some other species of the subgenus before me, one of which I describe below as new to science. I present below a key for the identification of these four species.

*Key to Species of Lucilia (s. s.).*

- |  |                            |
|--|----------------------------|
| 1. Wings with a broad black costal cloud.<br>(Africa.) .....   | <i>nigricosta</i> , sp. n. |
| Wings without trace of black costal cloud .  | 2.                         |
| 2. Abdominal tergites with dark blue or black<br>apices; calyptres brownish yellow; apical<br>bristles on third tergite very strong .... | <i>metilia</i> , Walk.     |
| Abdominal tergites without black or dark<br>apices; apical bristles on third tergite in-<br>conspicuous, though evident.....             | 3.                         |
| 3. Calyptres brownish yellow .....   | <i>inducta</i> , Walk.     |
| Calyptres white .....  | <i>cæsar</i> , L.          |

*Lucilia (Lucilia) metilia*, Walker.

I have seen this robust dark blue species only from Sumatra (*Karny*).

*Lucilia (Lucilia) inducta*, Walker.

I have seen this species from Java, Federated Malay States, and India. It is possible that this is *violacea*, Macquart, but the type of the latter should be examined by someone to verify if this is so.

*Lucilia (Lucilia) cæsar*, Linné.

I have seen this species from North America, Europe, and Siberia.

*Lucilia (Lucilia) nigricosta*, sp. n.

*Female*.—Metallic blue, with a pronounced violet lustre. Frons and upper occiput black, face and cheeks largely testaceous, frontal orbits white-dusted anteriorly, face white-dusted, cheeks and parafacials densely white-dusted, almost silvery; antennæ dark brown; palpi yellow. Thorax white-dusted, dorsum faintly vittate. Abdomen without dark apices to tergites, fourth visible, and incurved lateral portions of other tergites, white-dusted. Legs black. Wings greyish hyaline, with a black cloud on costa covering an area anterior to a line drawn from apex of posterior basal cell, behind inner cross-vein, to apex of third near wing-tip. Calyptræ blackish, white at bases. Halteres fuscous, knobs whitish.

Structurally and in chætotaxy as *cæsar*. Acrostichals 2+3; anterior pair of postsutural dorso-centrals strong. Apical bristles on third tergite rather weak. Hind tibia with about four short postero-dorsal bristles, the usual series of setulæ not evident.

Length 10–11 mm.

*Type* and *paratype*, Entebbe, Uganda, 1. viii. 1910, and 10. iii. 11 (C. C. Gowdey).

This species has a strong superficial resemblance to some of the species of *Chrysomya* with black costal streak.

## Subgenus LUCILIELLA, nov.

Differs from *Lucilia* in having the upper half of parafacials setulose and the head longer.

Type of subgenus, the following species.

*Lucilia (Lucieliella) fumicosta*, sp. n.

*Male* and *Female*.—Metallic blue-green. Head brown, occiput and fronto-orbits black, with whitish dusting; antennæ dark brown, apex of second and base of third segment reddish; palpi reddish testaceous. Thorax slightly white-dusted, without dorsal vittæ. Abdomen metallic blue-green in female, in male more or less golden on apical tergites, both sexes with dark apices to tergites. Legs black, tibiæ and tarsi brownish. Wings hyaline, with a brown cloud much as in *nigricosta*, but not so broad or so dark-coloured. Calyptræ dark brown, pale at base. Halteres fuscous.

Frons of male at narrowest part about as wide as third antennal segment, the orbits setulose to above middle, in female the frons is barely one-fourth of the head-width, with

narrow orbits and the usual bristles; parafacials about as wide as third antennal segment, setulose on upper half; face with some microscopic hairs below; cheek about one-fifth of the eye-height. Acrostichals 2+2. Bristles on third tergite long and strong.

Length 6-8 mm.

*Type*, male, Los Baños; allotype, one male and one female paratype, Mt. Maquiling, Luzon, Philippine Islands (C. F. Baker).

### Genus CATAPICEPHALA, Macquart.

A monobasic genus. The generic characters are as follows: Each orbit in female with two strong forwardly directed supraorbitals, the frons at vertex in that sex a little over one-fifth of the head-width, fully one-third of the head-width at anterior margin; facial ridges with a double series of setulæ to above middle; parafacials bare, the orbital bristles descending to opposite apex of second antennal segment; arista plumose almost to apex; otherwise the head is similar to that of normal species of *Calliphora*. Thorax with some fine prosternal hairs; propleura and supra-spiracular convexity bare, a few hairs below lower calyptre, and some on middle of postalar declivity, the supra-quamal ridge bare, presutural and postsutural acrostichals and dorso-centrals distinct, notopleurals 2; sterno-pleurals 2+1. Abdomen with the sternites of female strongly bristled. Otherwise much as the genus *Lucilia*.

### *Catapicephala splendens*, Macquart.

Metallic-green, abdomen glossy, with a coppery tinge on parts of dorsum, and white-dusted on lateral incurved portions of tergites. Head densely white-dusted; antennæ fuscous, base of third segment yellowish; palpi orange-yellow, darker basally. Legs black. Wings infuscated, paler behind.

Thoracic acrostichals 2+2, dorso-centrals 2+4. A pair of strong macrochætæ on middle of hind margin of second and another on third tergite. Fore tarsi of female not dilated. Venation as in *Lucilia*, extreme base of radius not setulose below.

Length 13-15 mm.

One female, Selangor, F.M.S., ix. 1915 (H. M. Pendlebury).

Apparently a rare and little-known species.

Genus *CALLIPHORA*, R.-D.*Calliphora croceipalpis*, Jaennicke.

A species with the general habitus and appearance of *erythrocephala*, Linné. The eyes are furnished with very short pubescence in male, in the same sex the frons is very narrow; in both sexes there are two silvery-white marks when the head is seen from the side, one at anterior margin of frontal orbit, the other at middle of parafacial; palpi bright orange; cheeks with black hairs, the haired part also black; mouth-margin broadly whitish. Prothoracic spiracle orange. Abdomen violet-blue, marked as in *erythrocephala*. Calyptre much as in that species, fuscous, with white margins and fringes. Basicosta silvery.

Length 8-10 mm.

*Localities.* New Langenburg, Tanganyika Territory, x. 1917 (*H. S. Stannus*); Embu, Kenya Colony, 20. ii. 1914 (*G. St. J. Orde-Browne*); Willow Grange, Natal, 30. iii. 1914 (*R. C. Wroughton*).

## Family Tachinidæ.

Genus *CYPHOCERA*, Robineau-Desvoidy.

This genus has the third antennal segment shorter than the elongated second; parafacial with a few strong bristles between vibrissæ and lower margin of eye in addition to the fine hairs; eyes bare; palpi absent; proboscis slender, not much elongated or geniculated; first vein bare; prosternum unarmed; postscutellum extending almost to tip of scutellum; ocellar bristles undeveloped.

*Cyphocera javana*, Wiedemann.

A black species, with dense greyish dusting. Head whitish yellow, antennæ and interfrontalia yellow, third antennal segment of former darkened apically; fine hairs on parafacials and cheeks whitish, the black postocular hairs ceasing before lower eye-margin. Thorax with five dark vittæ anteriorly, the three central vittæ linear. Abdominal tergites more or less rufous on sides, with pruinulent checkering. Legs black. Wings greyish.

Length 12-14 mm.

*Localities.* Java and Federated Malay States.

Genus *NEMOREA*, Robineau-Desvoidy.

A very distinct genus, which has been placed by some authors in *Dexiinae*. The arista is not conspicuously hairy,

being only distinctly pubescent, the face has a slight central vertical convexity, the eyes are hairy, and the lower calyptra has conspicuous erect hairs on the entire exposed part of its upper surface. This last character is almost if not quite unique in the group, though I have before me another genus in which there are some long hairs on the margins of lower calyptra in addition to the usual fringe of hairs on extreme margin.

*Nemoræa bicolor*, Macquart.

I consider the following as synonyms: *tropidobothra*, B. & B., and *grandis*, Walker. A very large robust species extending to a length of 15–18 mm., the male with black thorax and legs, and yellow abdomen with a black dorsal stripe which is tapered from base to apex. The wings are orange-yellow on almost the basal half, smoky hyaline, with conspicuously clouded veins, on apical half. Occiput golden-haired.

The male hypopygium has a pair of contiguous slender processes at base of the superior forceps, which are about five times as long as wide, furnished with dense fine hairs, except at apices where there are numerous long bristles. These processes when the hypopygium is retracted project backward from between the blunt processes of the fifth sternite and may be mistaken for an additional sternite.

*Locality.* Palaboeanratoe, Java.

LXII.—*Descriptions and Records of Bees.*—CX.

By T. D. A. COCKERELL, University of Colorado.

*Mesotrichia provida* (Smith).

♀.—New Guinea (the word on label looks like Gumea), taken out of cell in wood of banyan-tree. Presented by Mr. Armitage. Melbourne Museum.

The *Xylocopa provida* of Smith is, as Bingham remarks, represented by males only at the British Museum. At Oxford, however, I found females. Someone has written "*divisa*, Klug," on the pin-label of one of these, and, indeed, the species looks much like the African *M. divisa*, but is larger. There is also a very close resemblance to *M. incerta seychellensis*, Ckll., from the Seychelles, so that we begin to wonder whether these bees are not in fact related, and have

come from ancestors carried across the Indian Ocean in floating timber. From the Seychelles the Indian counter-current sets toward the Malay Archipelago.

As compared with the other two species mentioned, the large head with pale hair especially distinguishes *M. provida*.

*Crocisa omissa*, Cockerell.

Claudie River, N. Queensland (*Dr. Macgillivray*) ; Dunk Island, Q. (*C. L. Barrett*). Melbourne Museum.

*Anthophora æruginea*, Smith.

Claudie River, N. Queensland (*J. A. Kershaw*) ; Endeavour River, Q. (*F. P. Spry*). Melbourne Museum.

This is very probably the host of the above *Crocisa*.

*Nomia tomentifera*, Friese.

Dunk Island (*C. L. Barrett*). Melbourne Museum.

*Palmorhiza gigantea*, sp. n.

♀.—Length 15 mm., expanse about 24·5.

Robust, purple-blue, including legs, tegulae, and scape, middle of front greenish ; mandibles tridentate, black, with the base bluish ; maxillary palpi robust ; tongue broad and obtuse ; clypeus with scattered large but rather shallow punctures ; malar space large ; broad bands of cream-colour up each side of face, ending below level of antennae, but no median band ; flagellum black, obscurely brownish beneath ; vertex and occiput with coarse black hair ; thorax with thin white hair, dorsally mixed with black, long black hair on postscutellum ; mesothorax dull anteriorly, shining posteriorly, with irregular coarse punctures tending to run into grooves ; pleura splendidly purple, sides of metathorax greenish ; no light markings on thorax. Wings hyaline, stigma and nervures dark brown ; basal nervure falling considerably short of nervulus ; second cubital cell nearly twice as long as high, receiving recurrent nervures some distance from base and apex ; stigma slender, not large. Anterior and middle basitarsi covered with shining silvery hair ; anterior tarsi red at end and with no evident specialized hairs. Abdomen shining, with irregular punctures of different sizes ; segments basally greenish, apically purple, with broad impunctate margins ; apex with coarse black hair ; venter not

modified, almost bare. The area of metathorax is dull and black.

Raymond Island, 1908. Melbourne Museum.

Easily known from other species by the great size, blue colour, and lack of median stripe on face. It runs in my key next to *P. reginarum*, Ckll. The second cubital cell is much longer, and the stigma is smaller, than in *P. perviridis*, Ckll., the type of the genus.

*Palworhiza parallela* (Cockerell).

Dunk Island, Q. (C. L. Barrett). Melbourne Museum.

*Megachile doddiana clarkei*, Cockerell.

Gilbert River, N. Australia, Dec. 29, 1924 (Kenny). Melbourne Museum.

*Megachile conaminis*, sp. n.

♀.—Length 18 mm.

Stout, parallel-sided, black, with mainly black hair, but sides of face and front with pale hair, middle tarsi shining pale behind, and ventral scopa bright ferruginous, partly black on last segment. Wings dark fuliginous, with strong violaceous tints, the base pallid; eyes deep rosy-red. Head large; clypeus very short, widely excavated in middle, the moderately curved margin thickened and without denticles; mandibles extremely broad, quadridentate; middle of face with long coarse black hair; flagellum obscure brown beneath; vertex broad behind ocelli, shining, with scattered punctures; mesothorax dull, rather closely punctured; scutellum with much black hair; hind basitarsi broad. Abdomen shining, rather closely punctured, last dorsal segment with some pale hair near apex.

Endeavour River, Q., presented by F. P. Spry. Melbourne Museum.

A species of the subgenus *Eumegachile*, related to species of the Malay Region, but very distinct by the large size, parallel form, red scopa, and excavated clypeus.

*Megachile oppidalis*, sp. n.

♂.—Length 13–15 mm.

Black, parallel-sided, with the aspect of *M. fumipennis*, Smith. Head large, eyes black, inner orbits parallel; face and front covered with long white hair, easily denuded on

clypeus and supraclypeal area; clypeus and region above very minutely rugoso-punctate, no smooth line or ridge; mandibles elongate, bidentate; vertex broad, densely punctured, with thin short hair, partly dark and partly pale; antennæ black, ordinary, sometimes faintly reddish at extreme tips; cheeks broad, with sooty hair beneath; mesothorax and scutellum very densely and finely rugoso-punctate, the mesothorax with very short pale hair, the scutellum and mesothorax with soot-coloured hair; mesopleura with black hair, becoming pale beneath; area of metathorax glistening; tegulæ black. Wings dark fuliginous, shining violaceous; basal nervure falling short of nervulus; recurrent nervures about equally distant from ends of second cubital cell. Legs black, with dark hair; anterior coxæ not spined; anterior tarsi simple, ferruginous at ends of joints and base of last one; middle and hind tarsi with some red hair on inner side. Abdomen elongate, glistening but densely punctured; first dorsal segment covered with pure white hair; no hair-bands; segments 2 and 3 with extremely short black hair, on the others it is much longer and rusty black; sixth segment with a pair of rounded lobes and a deep depression between them; venter with black hair.

Townsville, Queensland (*G. F. Hill*). Three from Melbourne Museum.

Very much like *M. fumipennis*, but with dark hair on thorax posteriorly (at most pallescent laterally), larger scutellum, and much finer sculpture of mesothorax.

*Megachile aurifrons*, Smith.

♀.—Hughenden, Q. (*G. F. Hill*). Melb. Mus.  
Agrees with one from F. Smith's collection.

*Megachile rhodogastra*, Cockerell.

♂.—Townsville, Q. (*G. F. Hill*). Melb. Mus.

*Lithurgus rubricatus*, Smith.

♀.—New South Wales. Melb. Mus.

*Ctenoplectra australica*, sp. n.

♀.—Length about 10 mm., anterior wing 7·8 mm.

Black, with the abdomen shining purple-blue; pubescence black, white at sides of face, on cheeks, and conspicuous white tomentum at sides of base of metathorax dorsally;



antennæ dark red, the flagellum black above; large hind spurs of hind tibiæ light ferruginous posteriorly. Wings dilute fuliginous or smoky. Labrum with a pair of broad rounded dentiform processes; clypeus as closely punctured as possible, but glistening between the punctures, its upper middle with a triangular more or less shining area; ocelli black, all well formed, lateral ones bounded externally by a shining space; mesothorax and scutellum dullish, with excessively minute and dense punctures, the sculpture of scutellum like that of mesothorax; small joints of tarsi partly ferruginous.

Claudie River, North Queensland, 1914 (*Dr. Macgillivray*). Melbourne Museum.

This adds a genus and family to the Australian fauna. The species is very close to *C. chalybea*, Smith, originally described from Mt. Ophir, Malacca, but may be distinguished by the sculpture of the clypeus and scutellum. Friese records *C. chalybea* from New Guinea, but merely copies Smith's description, so we cannot tell whether his specimens were strictly identical with Smith's species. I have seen the species from Celebes.

*Neopasiphaë mirabilis*, Perkins.

♂.—W. Australia (*F. Duboulay*). Two from Melbourne Museum.

Previously known only by the unique type.

*Pachyprosopis hamatostoma*, Cockerell.

♀.—Healesville, Victoria (*R. Kelly*). Melbourne Museum.

*Euprosopis husela* (Cockerell).

♀.—Hughenden, Q. (*G. F. Hill*). Melbourne Museum.

*Hylæus (Prosopistemon) serotinellus* (Cockerell).

New syn. *Prosopis maculipennis*, Friese, Konowia, iii. (1924) p. 224

*Hylæus (Prosopistemon) melanops crassior*, subsp. n.

♀.—Distinctly larger and more robust. Wings browner; first recurrent nervure meeting first intercubitus. Scutellum dull, not polished. Abdomen broader.

Bayswater, 3. i. 15 (*F. S.*). Melbourne Museum.

*Euryglossa fasciatella*, Cockerell.

Both sexes, Sandringham, Victoria, Oct. 5 to 10 (*T. Rayment*). Melbourne Museum.

Stigma and nervures darker than usual.

*Euryglossa goodenia*, sp. n.

♀.—Length about 4.5 mm.

Pure black, including legs, antennæ, and tegulæ; pubescence pale and very scanty; clypeus dullish, sparsely punctured, broadly longitudinally depressed in middle; supra-clypeal area highly polished; front dull; thorax dull, the mesothorax minutely punctured; scutellum with a median depression. Wings dusky, stigma and nervures black; basal nervure falling short of nervulus; recurrents ending just before the intercubitals. Abdomen broad, convex, shining; venter with erect pure white hair. The broad emarginate tongue is pale ferruginous.

Sandringham, Victoria (*T. Rayment*).

Mr. Rayment informs me that this visits only *Goodenia ovata*, Sm. It is readily known from other species by the small size and entirely black colour.

*Parasphecodes speculiferus*, Cockerell.

♀.—Sandringham, Victoria (*T. Rayment*, 12).

*Ceratina philippinensis nigrolateralis*, Cockerell.

♀.—Puerto Princessa, Palawan, Aug. 17, at flowers of no. 6897, a grass (*McGregor*). A series of females, varying in size from 6 to 9.5 mm.

At the same flowers, at the same time, Mr. R. C. McGregor took *Nomia iridescens*, Sm., *N. strigata*, Fab., *Megachile metallescens*, Oekl., *Cathorys genalis*, Oekl. (tooth with fulvous abdominal bands), *Trigona biroi*, Friese (wings paler than usual), and *Apis indica*, Fab. (abdomen darker than in var. *nigrocincta*, Sm.). It is extraordinary to find all these bees at flowers of a grass.

*Paracollates euphonax*, Cockerell.

Four males from Sandringham, Victoria (*T. Rayment*; Melb. Mus.), certainly belong to this species, but differ a little from the type in the reddish colour of the hair on head above, the greater amount of black hair on dorsum of thorax,

and the black knees of middle legs. The type is from Brisbane, and it may be that the southern form is separable as a race. *P. obscurus* (Smith), described from Tasmania, appears to be closely related. The male of *P. obscurus* described by Smith is certainly not *P. euphenax*, but it is possible that Smith's male was wrongly associated with the female, the latter being properly the type.

*Paracolletes facialis*, Cockerell.

♂.—Sandringham, Victoria, October (*T. Rayment*).

Previously known only from Queensland. It is allied to the Tasmanian *P. leai*, Ckll., the latter being larger, with fulvous hair on tubercles. The dense pure white hair at sides of face is a striking character of *P. facialis*.

*Halictus seductus*, Cockerell.

♀.—Sandringham, Victoria (*T. Rayment*). Melbourne Museum.

*Halictus victoriellus*, Cockerell.

♀.—Sandringham, Victoria (*T. Rayment*, 8, 13).

Variable, but, so far as I can see, all one species. It is easily known from *H. imitans*, Ckll., by the area of metathorax. *Rayment's* 10, from the same place, is evidently the male, hitherto unknown. This is about 5.6 mm. long, the rather broad face and front covered with white hair, but clypeus exposed, polished, the lower portion broadly cream-colour; flagellum long, submoniliform, pale reddish beneath. Wings hyaline. Sculpture of mesothorax more delicate than in female; knees reddish; basitarsi dull whitish; small joints of tarsi reddish. Abdomen oval, hind margins of segments testaceous; a broad rounded red-margined apical plate; venter with crescentic bands of white hair. This male stands near to *H. plebeius*, Ckll., differing by the white hair covering face and front, colour of flagellum, very much shorter (crescentic) area of metathorax, &c.

*Halictus lanarius*, Smith.

♀.—Sandringham, Victoria (*T. Rayment*, 11).

*Nomia triangulifera*, Vachal.

♂.—East of Boulder, Colorado, Aug. 10, 1925 (*Clarence Custer*).

New to Colorado.

*Leptometria escomeli*, sp. n. (Fig. 1.)

♂.—Length about 9 mm., antennæ about 7.4 mm.

Black, with clypeus, labrum, and large spot on mandibles yellow; flagellum clear ferruginous beneath. Legs black, with small joints of tarsi ferruginous. Hind margins of abdominal segments testaceous, the first very narrowly, the others broadly; mesothorax shining, with scattered punctures; scutellum not grooved in middle; head and thorax above with light ferruginous hair, at sides and beneath it is white; tegulæ black in front, reddened posteriorly. Wings brownish, nervures and stigma piceous; venation differing from that of *L. pereyra*, Holub., in the longer marginal cell and first recurrent nervure joining second cubital very near end; basal nervure meeting nervulus; spurs pale ferruginous.

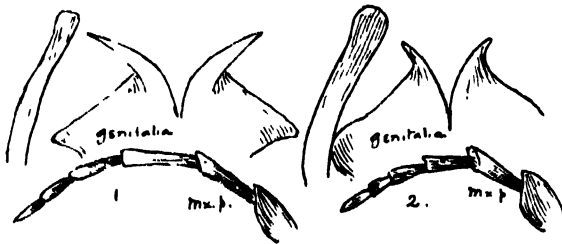


Fig. 1. —Maxillary palpi and male genitalia of *Leptometria escomeli*.  
Fig. 2.—Ditto of *Leptometria diplaspis*.

Abdomen shining, with pale hair. The following measurements are in microns:—Length of maxillary blade 2080; joints of maxillary palpi (2) 145, (3) 145, (4) 95, (5) 72, (6) 76.

Arequipa, Peru; twelve males collected by Dr. Edmundo Escomel.

*Leptometria diplaspis*, sp. n. (Fig. 2.)

♂.—Length about 8 mm.

So much like *L. escomeli* that I at first took it for a mere variety, distinguished by the shining bigibbous scutellum, with a deep median groove. The dorsal hair is only faintly yellowish, but is in poor condition. The genitalia and maxillary palpi clearly indicate a distinct species. Measurements in microns:—Length of maxillary blade 1790; joints of maxillary palpi (2) 145, (3) 95, (4) 80, (5) 50, 6 (76);

joints of labial palpi (1) 880, (2) 640, (3) 95, (4) 103; tongue extending 880 beyond labial palpi.

Arequipa, Peru, one male (*Escomel*).

The genus *Leptometria* appears to be ancestral to *Melissodes*, differing in the six-jointed maxillary palpi. It has numerous species in Argentina, and goes as far north as Ecuador (*L. pacifica*, Ckll.).

*Camptopœum inauratum*, Cockerell.

At Arequipa, Peru, Dr. Escomel has taken what is evidently the male of this species. It is smaller than the female, and the light face-markings include the whole clypeus, and large lateral marks filling space between clypeus and eye, and extending upward to end in a very acute angle on orbits about halfway up front. The broad black abdomen has hair-bands. The broadly truncate process of labrum is mainly light and the mandibles are light at base. The scape is black, the flagellum red beneath.

*Megachile grandibarbis*, Pérez.

Dr. Escomel took both sexes at Arequipa, Peru.

The female is about 12 mm. long; mandibles quadridentate; head with black hair; thorax above and first three abdominal segments with long greyish-white hair, rest of abdomen dorsally with black hair; ventral scopa very rich red, black at base and on apical segment; legs with black hair; tongue very long.

Vachal suggests that *M. rufohirta*, Friese, described from Arica, is the same species. In spite of some discrepancies in the description, I can hardly doubt that this is the case.

*Ptiloglossa eximia*, Smith.

Trinidad, B.W.I., both sexes (*Urich*).

New to Trinidad.

*Centris derasa*, Lepelletier.

Trinidad, B.W.I. (*Urich*).

New to Trinidad. Lepelletier's coloured figure shows the head and front legs with black hair, but it is actually red, as the description states. The figure appears to have been made from a specimen of *C. smithiana*, Friese.

*Centris nigrifula* (Friese).

Friese described this as a variety of *C. flavifrons* (Fab.),

from a female in the Munich Museum, labelled (of course, erroneously) "Africa." Three specimens are before me, collected in Trinidad, B.W.I. (*Urich*), and I think the form may rank as a species. In one specimen the inverted Y on the clypeus is connected with the lateral spots, forming an inverted T. Two males taken by *Urich* in Trinidad agree with typical *C. flavifrons*, except that the hair on the scutellum is strongly reddened and the black marks on the clypeus are much larger. If these belong with the *C. nigrītula* females, as appears likely, they constitute an argument against the specific distinctness of *nigrītula*.

*Centris pœcila*, Lepeletier.

Trinidad, B.W.I. (*F. W. Urich*).  
New to Trinidad.

*Centris personata*, Smith.

Trinidad, B.W.I. (*F. W. Urich*).  
New to Trinidad.

*Epicharis rustica flava*, Friese.

Four females from Trinidad (*Urich*) have the hair of the thorax above mixed with pale, producing a grey effect, the hair of the abdominal venter pallid, and the fifth abdominal tergite finely grey-pruinose all over, with outstanding black hairs. They are too near to Friese's variety *flava*, from Brazil, to be separated. The wings are purplish black, without the rosy tint of true *rustica*.

LXIII.—*Strongylus annulatus*, v. *Siebold*, and the Genus *Crenosoma*, *Molin*. By H. A. BAYLIS, M.A., D.Sc.

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THE British Museum (Natural History) possesses some of the original specimens of the Nematode named by v. Siebold (1848) *Strongylus annulatus*. These specimens, including one male, one complete and one fragmentary female, are now in rather poor and fragile condition, but their essential characters can be made out to a very considerable extent. V. Siebold, beyond mentioning the habitat (the air-passages of the wolf, *Canis lupus*) and the peculiar transverse annulations of the cuticle towards the anterior end, gives no

description of the worm. Molin (1861) renamed v. Siebold's worm "*Strongylus lupi*, Molin." This cannot, apparently, be intended for *S. lupi*, Rudolphi, 1809, since the latter was admitted later by Rudolphi (1819) to be a synonym of *Spiroptera* (now *Spirocerca*) *sanguinolenta*, with which *Strongylus lupi*, Molin, obviously has nothing to do. Molin makes no reference to Rudolphi's *Strongylus lupi*, but at the same time he gives no description of his own. In the same paper, however (1861), he gives a description of a worm named by him *Crenosoma semiarmatum*, from the bronchi of the fox, and mentions among its synonyms *Liorhynchus vulpis*, Dujardin, and *Strongylus decoratus*, Creplin. The latter is a *nomen nudum*, except for Creplin's (1847) statement in a footnote that the species is closely related to *Strongylus striatus*, Zeder.

Upon examination of v. Siebold's material, and comparison of the descriptions of *Liorhynchus vulpis* by Dujardin (1845) and of *Crenosoma semiarmatum* by Molin (1861), Stossich (1896), and Müller (1897), the present writer has formed the opinion that these worms are all identical. The account and figures of *C. semiarmatum* given by Müller (1897) are by far the fullest and most accurate, and v. Siebold's material agrees with this description in almost all respects. The dorsal ray of the male bursa, however, appears to be undivided except at its extreme tip, and not cleft for the greater part of its length as in Müller's figure. In this respect it agrees with the genotype, *C. striatum* (Zeder). All the rays of the bursa appear to be relatively longer and more slender, and more widely spaced, than in that species. Müller's measurement of the length (0.14 mm.) of the cuticular prominence upon which the vulva opens is probably due to an error in the position of the decimal point. In the specimens examined by the writer this papilliform vulvar prominence measures about 0.02 mm. in length.

The specimens of *Liorhynchus vulpis* studied by Dujardin appear to have been part of the same material, belonging to the Vienna Museum, upon which Molin based the species *Crenosoma semiarmatum*. The name *vulpis* therefore takes precedence of *semiarmatum*, and the correct name of the species should be *Crenosoma vulpis* (Dujardin, 1845), with the following synonyms:—

*Strongylus decoratus*, Creplin, 1847.

*Strongylus annulatus*, v. Siebold, 1848.

*Strongylus lupi*, Molin, 1861, nec Rudolphi, 1809.

*Crenosoma semiarmatum*, Molin, 1861.

The genus *Crenosoma* clearly belongs to the family *Metastrongylidæ*, the members of which are all parasites of the respiratory passages or circulatory system of mammals, and show a gradual reduction of the male bursa and its rays, culminating in the extremely modified forms (*Pseudalius*, *Stenurus*, *Torynurus*, and *Halocercus*) met with in the Cetacea. *Crenosoma* itself, however, does not show a very advanced degree of modification in this respect. The genotype is *C. striatum* (Zeder, 1800), which occurs in the bronchi of the hedgehog (*Ermaceus europæus*).

## REFERENCES.

- CREPLIN, F. 1847. "Zweiter Nachtr. zu Gurlt's Verzeichnisse der Thiere, etc." Arch. f. Naturg. xiii. 1, pp. 289-300.  
 DUJARDIN, F. 1845. 'Histoire naturelle des Helminthes.' Paris.  
 MOLIN, R. 1861. "Il Sottordine degli Acrofalli, etc." Mem. r. Ist. Veneto, ix. pp. 427-633, pls. xxv.-xxxiii.  
 MÜLLER, A. 1897. "Helminthologische Mittheilungen." Arch. f. Naturg. lxiii. 1, pp. 1-26, pls. i. iii.  
 RUDOLPH, C. A. 1819. 'Entozoorum Synopsis.' Berlin.  
 SIENOLD, C. VON. 1848. 'Lehrbuch der vergl. Anat. der wirbellosen Thiere.' Berlin.  
 STOSSICH, M. 1896. "Ricerche elmintologiche." Boll. Soc. Adriat. Sci. nat., Trieste, xvii. pp. 121-137, pls. iii., iv.

LXIV.—*New or little-known Tipulidæ (Diptera).—XXXI. Australasian Species.* By CHARLES P. ALEXANDER, Ph.D., F.E.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.

THE species herein described as new are all from New Zealand, most of them being included in the very extensive collections of Dr. A. L. Tonnoir. Additional material discussed at this time was secured by Messrs. Campbell, Gourlay, Harris, and Philpott. I express my deep thanks to all of these gentlemen for their tireless efforts in making known the crane-fly fauna of New Zealand. The Tonnoir material has been returned to the collector for redistribution in New Zealand collections. The other types are preserved in the collection of the writer through the kindness of Messrs. Campbell and Harris.

*Limnophila mira*, sp. n.

Head black, grey pruinose; thoracic notum rich reddish brown; wings tinged with greyish yellow, spotted with  
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brown; cell 1st  $M_2$  elongate, widened distally,  $m-cu$  far out toward the distal end of cell; abdominal segments weakly bicolorous; male hypopygium with the  $\alpha$ edeagus elongate.

*Male*.—Length about 6–6.5 mm.; wing 6–7 mm.

*Female*.—Length about 7 mm.; wing about 7 mm.

Rostrum short, dark brown; palpi brownish black. Antennæ of moderate length, in the male, if bent backward extending approximately to the base of the abdomen; antennæ brown throughout; flagellar segments elongate-oval to fusiform, provided with abundant erect setæ that are shorter than the segment. Head black, heavily dusted with grey, becoming more whitish anteriorly.

Pronotum brownish testaceous. Mesonotal præscutum rich reddish brown, subshiny, without markings, the lateral margins a little darker; no tuberculate pits; pseudosutural foveæ shallow, moderately large, triangular in outline; remainder of mesonotum a trifle darker, especially the postnotum. Pleura obscure brownish yellow, the anepisternum, sternopleurite, and pteropleurite darker. Halteres pale, the knobs a trifle darker. Legs with the coxæ yellow, subshiny; trochanters yellow; femora and tibiæ pale brown; tarsi passing into darker. Wings with a pale greyish-yellow tinge, cells  $C$  and  $Sc$  and the wing-base a little more yellowish; a conspicuous brown spotted pattern distributed as follows: Postarcular spot in cell  $R$ ; a large blotch at origin of  $Rs$ , not quite reaching  $M$ ; a small spot at tip of  $Sc$ ; stigma oval, dark brown; broad diffuse brown clouds and seams along cord, outer end of cell 1st  $M_2$  and as a spot at fork of  $M_{1+2}$ ; a large pale spot at tip of vein 2nd  $A$ ; cells  $M$  and  $Cu$  sometimes with a pale dusky wash; veins pale, darker in the infuscated areas. Veins with unusually long macrotrichiæ, longest and most conspicuous beyond the cord but persisting as gradually smaller trichiæ on all the veins almost to the arculus. Venation:  $Sc_2$  at tip of  $Sc_1$ , ending just before the fork of  $Rs$ , the latter long, strongly bent at the origin, in alignment with  $R_{2+3}$ ;  $R_2$  angulated at base;  $R_{2+3}$  one-half longer than the basal deflection of  $R_{4+5}$ ; cell  $M_1$  a little longer than its petiole; cell 1st  $M_2$  long, widened distally,  $m-cu$  from a little less than to its own length from the outer end of the cell; anterior arculus rather weakly preserved.

Abdominal segments weakly bicolorous, dark brown, the segments narrowly ringed caudally with paler, the basal sternites more conspicuously so; hypopygium obscure ochreous. Male hypopygium with the ninth tergite quadrate, the caudal margin with a very deep and narrow

parallel-sided notch, the lobes thus formed broadly sub-truncate. Basistyles relatively elongate, the apex produced into a small, obtuse, glabrous lobe. Outer dististyle slender, narrowed gradually to the apex which is split into two divergent teeth, the outer one broader; surface of style with abundant setiferous tubercles extending virtually to the base, these tubercles with conspicuous erect setæ; inner style a trifle longer, much broader, the apex obtusely rounded, the base markedly expanded and excavated. Aedeagus very elongate, slender, jutting caudad beyond the level of the basistyles, the apex microscopically fimbriate; phallosome at the base of aedeagus massive, the sides strongly angular.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Waiho, Westland, altitude 600 feet, January 16, 1922 (*A. Tonnoir*); collector's number 55.

*Allotopotype*, ♀, January 30, 1922.

*Paratopotype*, injured ♂, January 28, 1922.

The reference of this species to *Limnophila* is in the broad usage of the name only. I cannot indicate any close relatives.

*Limnophila scitula*, sp. n.

General coloration brown; halteres yellow; wings faintly tinged with grey, conspicuously spotted and clouded with brown, this including a series of marginal clouds at the ends of all the longitudinal veins, smallest at the wing-tip, largest in the anal field.

*Male*.—Length about 4.6 mm.; wing 6.5 mm.

Rostrum and palpi dark brown. Antennæ short, black throughout; flagellar segments oval, with moderately long verticils. Head broad, black, heavily dusted with yellow pollen.

Pronotum dark. Mesonotum brown, the præscutum with three scarcely evident slightly darker stripes; pseudosutural foveæ very conspicuous, black; notum very sparsely dusted with yellow pollen. Pleura and sternum brown, the former with a slightly darker dorsal longitudinal stripe extending from the cervical sclerites across the dorsal pleurites, surrounding the base of the halteres. Halteres relatively elongate, pale yellow, the extreme base dusky. Legs with the coxæ testaceous, the extreme bases infuscated; trochanters yellow, the mesal face of each with a black spot; femora light brown, with relatively long, subappressed setæ; tibiæ and tarsi brown. Wings with a faint grey tinge, the

base and cells *C* and *Sc* slightly more yellowish; membrane with numerous brown and grey spots and clouds; the brown areas include a postarcular spot in cells *Sc*, *R*, and *M*; a large spot at origin of *Rs* in cells *Sc* and *R*, not reaching vein *M*; a triangular area at tip of *Sc*<sub>1</sub> extending across cell 1st *R*<sub>1</sub> to *Rs*; the extensive stigma sends a seam over the fork of *R*<sub>2+3</sub>; seams along cord and outer end of cell 1st *M*<sub>2</sub>; slightly paler, more greyish clouds at tips of all longitudinal veins, largest on *R*<sub>2</sub> and *R*<sub>3</sub>, abruptly smaller on *R*<sub>4+5</sub>, that on vein 2nd *A* very large; anal angle extensively clouded; a large circular cloud at fork of *M*<sub>1+2</sub>; veins dark brown. Venation: *Sc*<sub>1</sub> ending just before the fork of *Rs*, *Sc*<sub>2</sub> some distance from its tip; *r* close to tip of *R*<sub>1</sub>; *R*<sub>2+3</sub> longer than the basal section of *R*<sub>2</sub>; cell *M*<sub>1</sub> a little shorter than its petiole; *m-cu* about one-half its length beyond the fork of *M*; anterior arculus weakly preserved.

Abdomen dark brown, the basal sternites paler. Male hypopygium of the general structure of *L. nebulifera*. Basistyle relatively slender, the apical lobe stout, setiferous. Outer dististyle a blackened clavate structure, enlarged outwardly, the tip a conspicuous spine; apical third with numerous smaller appressed spinulæ and setæ. Inner style subequal in length to the apical prolongation of the basistyle, slender, narrowed to the subacute apex. Gonapophyses appearing as narrow, elongate, flattened blades, the apex with a small black spine that is directed laterad and cephalad. Ædeagus slender, subtended by a hood-like ring, that leaves a lacuna on either side, as in *nebulifera*.

*Hab.* New Zealand (South Island).

*Holotype*, a damaged ♂, Maitai Valley, Nelson, March 16, 1922 (*A. Tonnoir*); collector's number 57.

*Limnophila scitula* is placed in this genus in the broad usage only. It belongs to the *nebulifera* group, which includes, besides these two species, the very distinct *L. tonnoiri*, Alexander. *L. scitula* has a hypopygium that is very similar to that of *nebulifera*, but differs conspicuously in the handsome restricted wing-pattern.

*Metalimnophila montivaga*, sp. n.

General coloration grey; wings tinged with yellow, the stigma only faintly darker; male hypopygium with the outer dististyle greatly expanded; ninth sternite produced medially into a conspicuous lobe.

*Male*.—Length about 4–4.2 mm.; wing 5.4–5.5 mm.

Rostrum and palpi dark brown. Antennæ elongate, dark

brown throughout, the basal segment slightly pruinose; antennæ extending to beyond mid-length of the abdomen. Head light grey, in some cases weakly infuscated.

Mesonotum grey, the præscutum with ill-defined brown stripes. Pleura clear grey. Halteres pale, the knobs vaguely darkened. Legs with the coxæ heavily grey pruinose; trochanters obscure brownish yellow; femora dark brown, the bases obscure yellow, more extensive on the elongate posterior legs where a little less than the proximal half is included; tibiæ and tarsi black. Wings tinged with yellow, the stigma very pale, brownish yellow; veins darker brown. Venation:  $Sc_1$  and  $Sc_2$  subequal or the latter a little longer, ending some distance before the end of  $R_s$ ;  $R_s$  relatively short, strongly arcuated at origin; veins  $R_2$  and  $R_3$  divergent; medial field of wing unusually plastic, in one specimen of the type-series with cell 1st  $M_2$  open by the atrophy of  $m$ ; in another with the outer deflection of  $M_3$  very long, obliquely subsinuate, obliterating  $m$ , the cell 1st  $M_2$  in this case being pointed at its outer end; cell  $M_1$  is likewise very variable in length and  $m-cu$  variable in its position.

Abdomen dark, heavily grey pruinose, the hypopygium reddish ochreous. Male hypopygium with the basistyles stout, the mesal apical angle produced caudad and slightly mesad into a moderately long, blunt lobe, the basal portion with two very long and several smaller setæ, the pale apex set with abundant recurved microscopic spinulæ and a few small apical setæ. Outer dististyle a flattened blade, at the apex greatly expanded, pale, the mesal margin before apex with a small pale tooth; inner style very slender, about two-thirds the length of the outer style, narrowed to the obtusely rounded apex, which terminates in a powerful seta. Gonapophyses appearing as a slender chitinized horn on either side, the tips bent laterad. Aedeagus expanded at apex, rather deeply cut into three subequal lobes. Ninth sternite produced medially into a conspicuous obtuse dusky lobe that is unarmed with spines.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Arthur Tableland, Nelson, altitude 4500 feet, December 1921 (*A. Tonnoir*); collector's number 64.

*Paratopotypes*, 3 ♂♂, altitude 4500–5000 feet, December 23–27, 1921 (*A. Tonnoir*).

I strongly suspect that this species may prove to be the unknown male of the fly described in the preceding installment as *Limnophila pissigrada*. However, there is no proof of this association and Dr. Tonnoir, the collector, did not

find the flies *in copula*. Until the insects are definitely associated, they must be held as distinct.

*Metalimnophila alpina*, sp. n.

General coloration dull grey, the præscutum with four narrow brown stripes; dorsal pleural stripe narrow and ill-delimited; stigma distinct; male hypopygium with the outer dististyle parallel-sided, the apex subtruncate; gonapophyses acute, decussate across the median line; ædeagus profoundly trifid.

*Male*.—Length about 5·5 mm.; wing 7–7·3 mm.

*Female*.—Length about 7 mm.; wing 8·5 mm.

Rostrum and palpi brownish black. Antennæ elongate, in the male, if bent backward, extending to about opposite one-third the length of the abdomen; scapal segments a trifle paler than the black flagellum. In the female the antennæ about attain the wing-root. Head grey, the vertex weakly infuscated.

Mesonotal præscutum dull grey, with four distinct brown stripes, these relatively narrow, of approximately equal width, the intermediate pair separated from one another by a space about equal to one-half the width of a single stripe; intermediate stripes becoming obsolete far before the suture; lateral stripes interrupted by the suture; scutal lobes dark grey with slightly darker centres; scutellum and postnotum light grey. Pleura light grey with a narrow and relatively ill-defined dorsal longitudinal stripe extending from the ventral cervical sclerites to the postnotum, passing above the base of the halteres; sternopleurite slightly more infuscated ventrally. Halteres pale, the extreme base of the stem brighter, the knobs obscure brownish yellow. Legs with the coxæ and trochanters obscure yellow; femora brown, the bases more yellowish, the tips narrowly infuscated; tibiæ brown, passing into dark brown outwardly; tarsi brownish black. Wings with a yellowish-grey tinge, the base and cells *C* and *Sc* more yellowish; stigma conspicuous, oval, brown; veins dark brown, the costal and prearcular veins more yellowish. Venation: *Sc*<sub>1</sub> a trifle longer than *Sc*<sub>2</sub>, ending opposite the fork of *Rs*; cell *M*<sub>1</sub> relatively short, from one-half to one-third its petiole; *m-cu* varying in position from a trifle less than to fully its own length beyond the fork of *M*.

Abdomen dark brown, the basal sternites obscure brownish yellow; hypopygium dark. Male hypopygium with the caudal margin of the ninth tergite bearing a small blunt tubercle

on either end of a broad U-shaped median notch. Basistyles stout, the mesal apical portion produced into three lobes, a slender curved lobe that is blackened at tip; a pale fleshy flattened setiferous lobe that lies in close connection with a deeply bifid glabrous lobe. Outer dististyle elongate, flattened, the sides generally parallel, very slightly expanded to the subtruncate darkened apex; lateral margins of style with several long powerful setæ, the restricted flattened apex densely covered with microscopic setiferous punctures. Inner dististyle unusually slender with a pale setiferous cushion at base. Gonapophyses appearing as long needle-like points directed mesad and slightly cephalad, decussate across the median line of the genital chamber. Ædeagus deeply split into three narrow chitinized blades, the median one broader, weakly expanded at tip, the lateral blades subequal in length, the tips subacute.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Arthur Tableland, Nelson, altitude 4500 feet, December 22, 1921 (*A. Tonnoir*); collector's number 66.

*Allotopotype*, ♀.

*Paratopotype*, ♂, December 26, 1921 (*A. Tonnoir*).

*Metalimnophila integra*, sp. n.

*Male*.—Length about 7 mm.; wing 7.6 mm.; antenna about 5 mm.

Generally similar to *M. greyana*, Alexander, differing in the more elongate antennæ of the male and the details of structure of the hypopygium.

Antennæ fully two-thirds the length of the entire body, the flagellar segments elongate-cylindrical with short verticils and a delicate erect microscopic pubescence. Ventral thoracic pleurites largely pale, the usual dorso-pleural stripe including only the dorsal pleurites. Wings with the stigma better defined. Venation:  $R_1$  beyond  $r$  short, subequal to  $R_{2+3}$ . Male hypopygium having the general structure of *greyana*, the mesal apical angle of the basistyle produced into a small, entire, darkened lobe, the apex broadly obtuse; the opposite mesal angle is produced into an extensive pale lobe that is much broader and more extensive than the one in *greyana*. Outer dististyle with two nearly apical spines, one a little stouter than the other. Inner dististyle of the general structure of *greyana*, but much shorter and stouter. Gonapophyses short, only a trifle longer than the ædeagus, the apices feebly expanded and hyaline. In *M. howesi*,

Alexander, the gonapophyses are elongate, sinuous, together appearing lyrriform.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Kaituna, Canterbury, February 19, 1922 (A. Tonnoir).

#### GYNOPLISTIA, Westwood.

1835. *Gynoplistia*, Westwood, London & Edinburgh Phil. Mag. & Journ. of Sci. vi. p. 280.  
 1835. *Cerozodia*, Westwood, *ibid.* vi. p. 281.  
 1835. *Gynoplistes* (*Anoplistes*), Westwood, Zool. Journ. v. p. 447.  
 1835. *Ozocera*, Westwood, *ibid.* v. p. 449.  
 1854. *Variegata*, Bigot, Ann. Soc. Entomol. France, (3) ii. p. 456.  
 1854. *Variptera*, Bigot, *ibid.* (3) ii. p. 471.  
 1865. *Ctedonia*, Philippi, Verh. zool.-bot. Ges. Wien, xv. p. 602.  
 1866. *Clontophora*, Schiner, *ibid.* xvi. p. 932; 1868. Reise Novara, p. 40.  
 1869. *Camarthria*, Thomson, Eugenes Resa, Dipt. p. 445.  
 1917. *Dirhipis*, Enderlein, Zool. Anzeig. xlix. p. 58.  
 1917. *Scepasma*, Enderlein, *ibid.* xlix. p. 60.

During the past decade there has been a tremendous increase in our knowledge of the species of *Gynoplistia*, especially of the Maorian Subregion where the genus apparently reaches its greatest specific development. In the past an attempt has been made to recognize as valid the three genera *Gynoplistia*, *Cerozodia*, and *Ctedonia*, and before the great accession of new types was made it had seemed possible that these generic groups might be maintained. It has now become apparent to the writer, however, that any serious attempt to divide the Hexatomine crane-flies with branched antennæ into valid generic groups is an impossibility, and all of the species described to date, considerably in excess of one hundred in number, should be referred to the oldest genus *Gynoplistia*.

Until this recent date, it had appeared that *Gynoplistia* might be defined as including those species with a moderate number of antennal segments (16 to 20) having relatively short branches; *Cerozodia* with a much greater number of segments (29 to 39), with the branches so long and slender as to give the organ a flabellate appearance; and *Ctedonia* with an intermediate number of segments (15 to 24), in most species with long slender branches and with seven or eight simple terminal segments. The distinctions between the two former groups were greatly weakened by the discovery of three remarkable Australian and Tasmanian species that the writer referred to *Cerozodia*, in which all the branches of the flagellum are of considerable length and all lie in a single

plane. Of these species, *Gynoplistia flavipes* has 25 antennal segments, the formula being  $2+21+2$ , while *G. minuscula* has only 16 segments with a formula of  $2+12+2$ . As regards the number and arrangement of the unbranched terminal segments, *Ctedonia* is closely approached by two species of *Gynoplistia* from Celebes, *G. jucunda*, Osten-Sacken, and *G. octo-fasciata*, Brunetti, which have eight terminal unbranched segments as in the genotype of *Ctedonia* (*bicolor*, Philippi). The structure of the branched segments and the arrangement of setæ upon them that is found in *Ctedonia* is closely approached by the Queensland *G. doddi*, Alexander, which has a 21-segmented antenna having the formula  $2+3+17+2$ . The aberrant *Ctedonia bipunctata*, Philippi, which was made the type of a supposed new genus, *Scerpasma*, by Enderlein, has a 15-segmented antenna with the formula  $2+2+7+1$ , this being exactly duplicated by a series of New Zealand *Gynoplistiæ* (*G. aurantiopyga*, Alexander, *G. dimidiata*, Alexander, *G. luteibasis*, Alexander, *G. nigrobimbo*, Alexander). As long ago as 1888, Reed ('Anales de la Universidad de Chile,' lxxiii, p. 1) referred the Chilean species of *Ctedonia* to the genus *Gynoplistia*, and the writer now has no doubt but that such a reference is correct.

The tremendous recent development in our knowledge of the New Zealand Tipulid fauna has now brought the list of *Gynoplistiæ* for the Maorian Subregion to approximately 90 species, and this number is certain to be considerably added to. In this great complex of species we find a range in number of antennal segments that is quite unparalleled in any other group of crane-flies so far made known. In size, the species range from tiny flies (*G. hyalinata*, Alexander, *G. pygmaea*, Alexander) that rank among the smallest of the Hexomini, to veritable giants that are among the largest of the tribe (*G. hiemalis*, Alexander, *G. paradisea*, Edwards, *G. plumosa*, Osten-Sacken, etc.). The antennal structure, the proportions of branched to unbranched segments and the directions taken by the various branches, attains a vast range and complexity. In the New Zealand fauna alone we find in the genus *Gynoplistia* a range in the number of antennal segments that is virtually as extensive as is found in the entire family Tipulidæ, excluding the aberrant Hexatomaria. This range is indicated as follows:—13 segments (*albicincta*, Edwards, *dispiloides*, sp. n.); 14 (*nematomera*, sp. n., *trifasciata*, Edwards); 15 (*aurantiopyga*, Alexander, *bidentata*, Alexander, *bucera*, Alexander, *campbelli*, Alexander, *clavipes*, Edwards, *dimidiata*, Alexander, *dispila*, Alexander, *flavohalterata*, Alexander, *hirtamera*, Alexander, *luteibasis*,



Alexander, *nigrobimbo*, Alexander, *pygmæa*, Alexander, *recurvata*, Alexander, *subclavipes*, Alexander); 16 (*ambulator*, Alexander, *bituberculata*, Alexander, *cladophora*, Alexander, *conjuncta*, Edwards, *dactylophora*, sp. n., *inconjuncta*, sp. n., *myersæ*, Alexander, *nebulipennis*, Alexander, *nigronitida*, Edwards, *pedestris*, Edwards, *pleuralis*, Alexander, and variety *plutonis*, subsp. n., *wakefieldi*, Westwood); 17 (*aculeata*, Alexander, *arthuriana*, Edwards, *bona*, Alexander, *concava*, Alexander, *eluta*, Alexander, *finbriata*, Alexander, *fuscophumbea*, Edwards, *generosa*, sp. n., *glauca*, Edwards, *hirsuticauda*, Alexander, *incisa*, Edwards, *inflata*, sp. n., *pallidistigma*, Alexander, *sackeni*, Alexander, *spinigera*, Alexander, *subfasciata*, Walker); 18 (*magnifica*, Edwards, *nebulosa*, Edwards, *notata*, Edwards, *violacea*, Edwards); 19 (*hamiltoni*, Alexander); 20 (*cuprea*, Hutton, *fulgens*, Hutton, *hiemalis*, Alexander, *niveicincta*, Alexander, *ocellifera*, Alexander, *subobsoleta*, Alexander, *tridactyla*, Edwards); 21 (*subformosa*, Alexander, *trispinosa*, Alexander); 22 (*formosa*, Hutton, *luteicincta*, Alexander); 23 (*princeps*, Alexander); 29 (*paradisea*, Edwards); 31 (*pulverulenta*, Edwards); 33 (*hudsoni*, Edwards); 39 (typical *plumosa*, Osten-Sacken).

The placing of *Ctedonia* in the synonymy of *Gynoplistia* has rendered it necessary to re-name *Gynoplistia flavipennis*, Skuse (Proc. Linn. Soc. New South Wales, (2) iv. pp. 877-878, pl. xxiii. fig. 38, 1889), which is preoccupied by *G. flavipennis*, Philippi (Verh. zool.-bot. Ges. Wien, xv. p. 602 (*Ctedonia*); 1865). The name *Gynoplistia skusei*, nom. nov., is herewith proposed to replace this preoccupied term.

*Gynoplistia nigripennis*, nom. nov.

1923. *Gynoplistia fumipennis*, Alexander, Proc. Hawaiian Ent. Soc. v. p. 253, preoccupied by *Gynoplistia fumipennis*, Walker, Ins. Saundersiana, Dipt. p. 448 (1856).

*Gynoplistia cuprea percara*, subsp. n.

*Male*.—Length about 12 mm.; wing 11.5-11.8 mm.

Generally similar to typical *cuprea*, Hutton, differing as follows:—

Antennæ of male 21-segmented (2 + 2 + 13 + 4) or 22-segmented (2 + 2 + 14 + 4). Spots behind the antennal fossa and the occipital region reddish. Tubercle on postnotal pleurotergite larger and more conspicuous. Pubescent area on pleura more golden-yellow. Wings very conspicuously yellow, much brighter-coloured than in the typical form, with a dark brown pattern that is arranged about the same, with minor exceptions: yellow area enclosed between the

cord and wing-apex small; brown area at origin of *Rs* conspicuous, connected with the cord by a seam along *M*; anal margin with a conspicuous dark triangular marking extending as far basad as the distal end of cell 2nd *A*, but the base of this cell and all the other cells of the wing almost to the level of the origin of *Rs* clear yellow; veins brown, all the veins in the flavous basal area clear yellow, concolorous with or but slightly darker than the ground-colour. Male hypopygium having the tergite with a small but conspicuous median triangular lobe. Gonapophyses shorter, stouter, heavily chitinized almost to their bases.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Aniseed Valley, Nelson, December 1-4, 1923 (*A. Tonnoir*); collector's number 31.

*Paratopotype*, ♂.

*Gynoplistia violacea persimilis*, subsp. n.

Very similar to the typical *violacea*, Edwards, differing as follows:—

Legs generally similar, the posterior tarsi considerably longer (♂, posterior basitarsus, 2.5 mm.; in *violacea*, ♂, 2 mm.). The wing-pattern of the type-series is very pale, in a few cases virtually obsolete with the exception of the dark stigma which is always well-indicated; cell 2nd *R*<sub>1</sub> virtually all clear, only the extreme base darkened. Vein *R*<sub>2</sub> has a course that is very different from the typical form, being much longer and running generally parallel to *R*<sub>3</sub> to opposite *r*, thence diverging very gently. In *violacea*, vein *R*<sub>2</sub> is unusually short and straight, diverging very strongly from *R*<sub>3</sub> so it lies close to *R*<sub>1</sub> at the wing-margin, cell 2nd *R*<sub>1</sub> being reduced to a tiny area that is entirely infuscated.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Arthur Tableland, Nelson, altitude 4500 feet, December 22, 1921 (*A. Tonnoir*); collector's number 88.

*Allotopotype*, ♀, December 27, 1921.

*Paratopotypes*, 2 ♂♂, 1 ♀, altitude 4000-4500 feet, December 21-24, 1921 (*A. Tonnoir*); 1 ♂, 4500 feet, December 12, 1922 (*A. Philpott*).

*Gynoplistia notabilis*, sp. n.

Allied to *G. magnifica*, Edwards; antennæ with 8 long-branched flagellar segments; vertex with a  $\Omega$ -shaped brown

marking; wings greyish subhyaline, spotted and dotted with brown; cell *M* not conspicuously infumed.

*Sex*?—Wing 12.5 mm.

Rostrum pale brown, the palpi dark brown. Antennæ 17-segmented, the formula being 2+8+7; basal segment of scape elongate, dark above, obscure yellow beneath; flagellar segments 2–4 with the tips narrowly yellowish, the remainder of the organ dark brown; first flagellar segment with a broad-based spur that is about as long as the segment; longest branches (flagellar segments 3 to 6) a little less than three times the length of the segment; terminal segment elongate, one-half longer than the penultimate. Head light grey, the vertex with two conspicuous brown lines that unite anteriorly to form a  $\Omega$ -shaped marking.

Pronotum variegated pale and darker brown. Mesonotal præscutum extensively striped with dark brown, these markings almost covering the notum except for a pale capillary vitta on either side of a narrow median stripe; extreme anterior and lateral margins of sclerite restrictedly light grey; pseudosutural foveæ conspicuous, reddish brown; scutum grey, the mesal edges and anterior margins of the lobes ringed with brown; scutellum grey, the parascutella darker; postnotum brown, more reddish brown behind, pruinose. Pleura heavily light grey pruinose. Halteres yellow, the knobs dark brown. Legs with the coxæ heavily dusted with light grey; trochanters obscure yellow; remainder of legs broken. Wings greyish subhyaline, with a pattern that is approximately as in *magnifica*, but even more broken up; dusky clouding in distal cells of wing more extensive; several small dots and spots in cells *M* and *Cu*; ocelliform markings at fork of  $M_{1+2}$ , surrounding cell 1st  $M_3$  and in cells 1st *A* and 2nd *A*; no conspicuous dusky wash in cells *M* and  $M_4$  as in *magnifica*. Venation: cell  $R_2$  very short-petiolate to sessile.

Abdomen broken near mid-length; basal tergite with the lateral angles dark grey; remaining tergites brownish yellow.

*Hab.* New Zealand (South Island).

*Holotype*, Sex?, Aniseed Valley, Nelson, December 1–4, 1923 (*A. Tonnoir*); collector's number 28 *b*.

"In spider's web."

From the structure of the antennæ, the unique broken type would certainly appear to be a female, there being only eight branched segments. In this case, the flagellar branches are of a length that is quite unusual in the *magnifica* group.

*Gynoplistia generosa*, sp. n.

General coloration chestnut-brown, the pleura pruinose; antennæ 17-segmented, with 11 branched segments; halteres orange-yellow; femora unbanded; wings rich yellow, the usual brown pattern very diffuse, many of the cells with longitudinal hyaline streaks; male hypopygium with the caudal margin of the tergite deeply U-shaped, densely hairy; outer dististyle terminating in a long acute point.

*Male*.—Length about 11 mm.; wing 12 mm.

Rostrum reddish, sparsely pruinose; palpi brownish black. Antennæ 17-segmented, the formula being 2 + 2 + 9 + 4; scapal segments brownish yellow; incisures of basal two flagellar segments pale brown; remainder of antennæ black; longest branch approximately one-third the flagellum. Head brownish grey.

Mesonotum chestnut-brown, very vaguely dusted; præscutum with the antero-median portion restrictedly darkened. Pleura light brown, the anepisternum, sternopleurite, meron, and katepisternum dusted with light grey. Postnotal pleurotergite more sparsely dusted. Halteres orange-yellow, the knobs very faintly infuscated. Legs with the coxæ reddish brown, very sparsely pruinose; trochanters obscure yellow; femora light brown, the bases paler; tibiæ and tarsi somewhat darker brown. Wings with a rich yellow ground-colour, the usual markings diffuse and ill-delimited, pale brown, consisting of a slightly darker stigmal spot; seam along cord; spot at origin of *Rs* and another opposite this in cell 1st *A*; cells *C* and *Sc* somewhat more saturated; linear hyaline streaks in cells *R*, *M*, 1st *M*<sub>2</sub>, *M*<sub>3</sub>, *R*<sub>2</sub>, *R*<sub>3</sub>, and less distinctly in the base of cell 1st *A*; wing-apex vaguely darkened; veins brownish yellow. Venation: *Rs* long, strongly angulated at origin; *r* close to tip of *R*<sub>1</sub>; *R*<sub>2+3</sub> a little shorter than the arcuated basal deflection of *R*<sub>4+5</sub>; cell *M*<sub>1</sub> from once and one-half to twice its petiole; *m-cu* at or beyond two-thirds the length of the lower face of cell 1st *M*<sub>2</sub>.

Abdomen with the basal tergite infuscated; remaining tergites brownish yellow with an indistinct dorso-median brown line; hypopygium scarcely darker. Male hypopygium with the ninth tergite large, the caudal margin with a very conspicuous U-shaped notch, the sublateral lobes thus formed slender, the tips subacute; dorsal surface of tergite with dense long yellow setæ. Basistyle relatively stout, the caudo-mesal angle produced mesad into a blunt irregular lobe, the extreme apex of which is still further produced into

a narrow margin; lateral face of basistyle with numerous setæ that become very long and dense on the caudal-lateral portions of the style. Outer dististyle slender, the apex a long oblique blade that runs out into a slender acute black point, this blade cut off by a U-shaped notch on the outer edge of the style at just beyond two-thirds the length, the proximal angle of the notch an acute spinous lobe; surface of style surrounding this latter spine with a group of more than a score of long setæ. Inner dististyle more slender, before the apex on outer margin with a linear row of five powerful setæ; remainder of style with numerous additional smaller setæ. Gonopophyses very strongly sinuous.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Reefton, Nelson, January 13, 1922 (*A. Tonnoir*); collector's number 26.

*Gynoplistia generosa* bears a general superficial resemblance to a small *G. princeps*, Alexander.

*Gynoplistia inflata*, sp. n.

General colour grey; antennæ 17-segmented, in the ♂ with ten branched segments; femora with a conspicuous subterminal orange ring; male hypopygium with the outer dististyle broadly dilated apically, the surface weakly serrulate.

*Male*.—Length about 11 mm.; wing 10.5–10.8 mm.

*Female*.—Length about 11.5–13 mm.; wing 10.2–11 mm.

Rostrum grey; palpi brownish black. Antennæ 17-segmented, the formula being 2+5+5+5 or 2+4+6+5 in the ♂; antennæ black, the basal segment pruinose; extreme base of first flagellar segment a trifle paler; branch of first flagellar segment about two-thirds the length of that of the second segment; longest branch (about flagellar segment 7) a little less than four times the length of the segment; branch of flagellar segment 10 about one-half longer than the segment; flagellar segment 11 with a slight basal lobe; terminal segment about one-half longer than the penultimate. In the ♀ the formula is 2+8+7, the longest branches about equal in length to the segments bearing them; scapal segments a trifle paler than the flagellum. The allotype shows but sixteen antennal segments and may not be conspecific with the type. Head light grey, the disk of the vertex more or less suffused with brown, the marking usually trifoliate in appearance.

Prothorax and mesothorax grey, the præscutum with three brown stripes, the median one further split by a slightly

darker capillary vitta that extends cephalad to the margin of the sclerite; remainder of median stripe narrowly replaced by grey in front, more extensively so behind; lateral stripes beginning behind the conspicuous transverse black pseudo-sutural foveæ; cephalic portions of scutal lobes a little infuscated; scutellum and postnotum dark grey. Pleura clear grey. Halteres yellow, the knobs dark brown. Legs with the coxæ light reddish brown, very sparsely pruinose; trochanters concolorous; femora obscure brownish yellow basally, soon passing into dark brown or black, the pale bases more extensive on the fore legs; all femora with a conspicuous orange ring a little more than its own length from the tips; tibiæ brown, the tips a little darkened; tarsi dark brown. Wings somewhat variable in colour, in fully-coloured specimens with cells *C* and *Sc* darkened; wing-tip strongly though narrowly infumed; distinct brown clouds in base of cell *R*, at mid-length of cell *Cu*, and near outer end of cell 1st *A*; all specimens have the stigma, a more or less distinct seam along the cord, and a spot of various sizes at origin of *Rs*; veins brown to dark brown. Venation: *Sc* long, *Sc*<sub>1</sub> and *Sc*<sub>2</sub> subequal, both ending just beyond the fork of *Rs*; *Rs* long; *R*<sub>2+3</sub> and basal deflection of *R*<sub>4+5</sub> subequal; cell 1st *M*<sub>2</sub> of moderate size, varying from subquadrate to rectangular; cell *M*<sub>1</sub> from one-half to one-third longer than its petiole; *m-cu* beyond mid-length of cell 1st *M*<sub>2</sub>.

Abdomen dark brown, the tergites faintly dark grey pruinose; sternites concolorous, the caudal margins of the segments somewhat paler; subterminal segments darker; hypopygium orange. Male hypopygium with the tergite broadly truncated apically, in cases even feebly concave, with a low tubercle on either side at the margin of the concavity. Basistyles narrowed apically, the mesal face and mesal apical angle with abundant setæ; no evident inter-basal lobe. Outer dististyle very broad, pale, just beyond mid-length with a low chitinized tooth on the outer margin, beyond this point the blade very deep, flattened, the surface, and especially the margin, microscopically serrulate; surface of style back from this tooth with a group of about fourteen long setæ. Inner dististyle arcuate, narrowed gradually to the obtuse apex, the surface with four long setæ in a single row and an abundance of more delicate erect setæ on the basal portions. Gonapophyses closely subtending the short curved ædeagus, lying parallel to one another, virtually contiguous, separated apically by a V-shaped notch, these

divergent tips with their mesal edges with two or three serrations; from the basal lateral angles of each apophysis a long, very slender, sinuous lateral arm directed caudad.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Arthur Tableland, altitude 4000 feet, December 24, 1921 (*A. Tonnoir*); collector's number 25.

*Allotopotype*, ♀, altitude 1500 feet, December 27, 1921 (*A. Tonnoir*).

*Paratopotypes*, 2 ♂♂, 1 ♀, altitude 4000–1500 feet, December 24–27, 1921 (*A. Tonnoir*); 1 ♀, January 1924 (*A. Philpott*).

*Gynoplistia inconjuncta*, sp. n.

Closely allied to *G. conjuncta*, Edwards, antennæ 16-segmented, with ten branched segments; præscutal stripes cinnamon-brown; pseudosutural foveæ black; wings relatively long and narrow, the markings confined to the stigma and small spots at origin of *Rs* and along the basal deflection of  $R_{4+5}$ ; *r-m* distinct.

*Male*.—Length about 12 mm.; wing 9.2 mm., its greatest width 1.9 mm.

Rostrum light grey; palpi dark brown. Antennæ black throughout; basal segment of scape pruinose; antennæ 16-segmented, the formula being 2+5+5+1; branch of first segment a trifle more than the length of the segment, strongly curved; longest branch (about flagellar segment 6 or 7) a trifle more than twice the length of the segment; flagellar segment 10 with a branch that is about one-half the segment; the left antenna of the type is abnormal in having only fifteen segments, the formula being 2+5+4+4. Head grey, the disk of the vertex infuscated.

Pronotum grey. Mesonotal præscutum grey with four cinnamon-brown stripes, the intermediate pair narrow and indicated only behind, the anterior half obliterated; lateral stripes broader; lateral margin of præscutum light brown; pseudosutural foveæ black; scutal lobes grey, only the extreme sutural portion brown; postnotum reddish brown, sparsely pruinose. Pleura grey pruinose. Halteres obscure yellow, the knobs weakly darkened. Legs with the coxæ large, reddish brown, sparsely pruinose; trochanters obscure yellow; femora dark brown, the bases a little paler; vague indications of a paler subterminal annulus; tibiæ and tarsi dark brown. Wings relatively long and narrow, subhyaline, the base and cells *C* and *Sc* more yellowish; stigma pale brownish yellow; very small brown clouds at origin of *Rs*

and on the basal deflection of  $R_{4+5}$ ; remainder of wing virtually clear; veins brownish black, those in the costal and prearcular region yellowish, veins  $M$ ,  $Cu$ , and  $A$  almost black. Venation:  $R_s$  long, angulated and weakly spurred at origin;  $r$  only a little more than its own length from the tip of  $R_1$ ;  $R_{2+3}$  and basal deflection of  $R_{4+5}$  subequal;  $r-m$  present, longer than  $m$ ; cell  $M_1$  one-third longer than its petiole; cell 1st  $M_2$  elongate-rectangular,  $m-cu$  near mid-length.

Abdominal tergites dark grey, with an interrupted dorso-median brown stripe, the areas interrupted basally and more narrowly at the caudal margins of the segments, more expanded at their posterior ends; lateral margins of tergites narrowly ochreous; sternites grey, the posterior margins of the segments narrowly ochreous; hypopygium ochreous. Male hypopygium very similar in structure to *G. conjuncta*. Lobe on ninth tergite roughened, but not blackened. Basistyles with the blackened interbasal lobe a little shorter, the cephalic beak straighter. Outer dististyle more slender, more heavily chitinized apically, the subterminal spine not extending beyond the apex; some distance before the margin at near two-thirds the length of the style a very low blackened tubercle; apex of style weakly serrulate; subterminal spine acute, blackened; surface of style with seven or eight long setæ.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Gordon Pyramid, Mt. Arthur, Nelson, January 1924 (*A. Philpott*); Tonnoir's number 25 b.

*Gynoplistia dactylophora*, sp. n.

Allied to *G. aurantiopyga*, Alexander; antennæ 16-segmented, with twelve branched segments; halteres orange; wings broad, whitish, with a sparse brown pattern, the apex almost clear; male hypopygium with the end of the basistyle produced into a long slender lobe that runs out into a slender chitinized point.

*Female*.—Length about 7 mm.; wing 8.1 mm.

Rostrum and palpi black. Antennæ 16-segmented, the formula being  $2+2+10+2$ ; antennæ black throughout; longest branch about two-fifths the length of the flagellum; branch of twelfth flagellar segment about one-half longer than the segment. Head black, sparsely dusted with grey; vertex between the eyes broad.

Thorax black, the pleura more dusted with grey. Halteres orange, only the extreme base of the stem darkened. Legs with the coxæ dark brown; trochanters obscure yellow;



femora yellow, the tips rather narrowly but conspicuously brownish black, the amount proportionately subequal on all the legs; posterior femora conspicuously longer than the others; tibiæ yellow, the tips narrowly blackened; tarsal segments 1 and 2 yellowish brown, the tips narrowly blackened; terminal tarsal segments black. Wings broad, whitish subhyaline, with a sparse brown pattern; base and cells *C* and *Sc* yellowish brown; stigma brown; brown marks at base of cell *R*, beneath the origin of *Rs*, in base of cell *Cu*, and a spot in distal half of each anal cell; cord and outer end of cell 1st *M*<sub>2</sub> very narrowly seamed with darker; wing-apex clear; veins brown. Venation: *Rs* strongly angulated at origin; *R*<sub>2+3</sub> in alignment with *Rs*, shorter than *r*; cell *M*<sub>1</sub> longer than its petiole; *m-cu* near mid-length of cell 1st *M*<sub>2</sub>.

Abdomen black, the hypopygium obscure orange. Male hypopygium with the tergite produced into a long median spine, the apex of which is glabrous; basal portion of tergite with long conspicuous setæ, especially at the cando-lateral angles. Basistyle relatively stout, the dorso-caudal angle produced mesad and slightly cephalad into a long, slender, straight rod that is longer than either dististyle, tapering gradually to the acute chitinized apex, the basal three-fourths or more with long conspicuous setæ that are larger and more powerful at the base; ventro-mesal face of basistyle with a conspicuous fleshy setiferous lobe; a still smaller, densely setiferous lobe on dorso-mesal face of basistyle. Dististyles two, the outer a flattened glabrous blade that terminates in two acute points, the more dorsal one subtended by a broad flattened wing; inner style provided with small setæ, the inner margin with a U-shaped notch before the apex, cutting off a flattened, sparsely setiferous, darkened apex. Each gonapophysis appearing as a relatively stout rod that gradually narrows to the subacute apex.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Arthur Tableland, Nelson, altitude 5000 feet, December 23, 1921 (*A. Tonnoir*); collector's number 34.

*Gynoplistia pleuralis plutonis*, subsp. n.

*Male*.—Length about 8.4 mm.; wing 8 mm.

Differs from typical *pleuralis*, Alexander, as follows:—

Pronotum and mesonotum entirely black. Pleura entirely black, very sparsely pruinose. Legs with all the coxæ black, the trochanters dark brown; femora black, only

the basal third or less obscure brownish yellow ; remainder of legs black. Wings with the black marking at origin of *Rs* very extensive, wider than the band at the cord, crossing vein *M* and occupying an even longer space in cell *M*, the band virtually crossing the wing, being interrupted only in the costal cell and for a short space behind vein *Cu* ; a small postarcular cloud in cell *R*. Abdomen entirely black, including the hypopygium, only the styli of the latter obscure yellow. Male hypopygium very similar in structure, the inner dististyle with a linear series of five or six powerful bristles along the outer margin, the distal two being much smaller.

The antennæ are quite as in the typical form, being 16-segmented with the terminal two segments simple.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Aniseed Valley, Nelson, December 1-4, 1923 (*A. Tonnoir*) ; collector's number 40*b*.

The general appearance of this fly is very different from typical *pleuralis*, but the differences are chiefly colorational and it is better to consider this as being a subspecies.

*Gynoplistia serrulata*, sp. n.

Thorax chestnut-brown ; head shiny black ; antennæ 15-segmented, in the ♀ simply serrulate ; posterior tibiæ with a broad white annulus ; wings whitish subhyaline, heavily marked with dark brown ; abdomen blue-black, the genital segment and very long terebra orange.

*Female*.—Length about 9-9.5 mm. ; wing 7.7-7.9 mm.

Rostrum black ; palpi dark brown. Antennæ 15-segmented, the formula (♀) being 2+6+7 ; the serrations of the basal five flagellar segments are very short, the longest (flagellar segment 3) only about two-thirds the segment ; all serrations very broad-based, being united with the segment for all except a slight apical portion ; pectination of flagellar segment 6 reduced to a tiny subapical tubercle ; terminal segments oval, the ultimate about one-half longer than the penultimate ; scapal segments obscure brownish yellow ; flagellum black, the axis of the basal two segments brownish yellow. Head broad, shiny black ; a low tubercle immediately caudad of each antennal fossa.

Pronotum shiny dark brown to brownish black. Mesonotum shiny chestnut-brown, with vague indications of a darker median area on the præscutum. Pleura darker chestnut-brown ; a conspicuous transverse area of appressed silvery-white pubescence on the anepisternum, extending

ventrad on to the dorsal edge of the sternopleurite. Halteres obscure yellow, the knobs dark brown. Legs with the coxæ and trochanters obscure yellow, shiny; femora clavate, yellow, the apices conspicuously dark brown, more extensive on the fore legs where more than the outer half is darkened; on the posterior femora the tips are narrower, but black and well-delimited; tibiæ black, the posterior tibiæ with a broad obscure white annulus beyond mid-length, the setæ on this ring dark-coloured; tarsi black. Wings whitish subhyaline, with a conspicuous dark brown pattern; cell *Sc* dark; a quadrate area at origin of *Rs*, completely traversing cell *R*; a conspicuous wash beginning as a tiny spot near the base of cell *M*, occupying all of the space behind vein *Cu* and crossing the semi-atrophied *Cu*, to occupy more than the basal half of cell *Cu*, finally crossing vein 1st *A* and occupying the distal end of the cell; a broad band completely traverses the wing at the cord, including the slightly darker oval stigma; this band is narrowest at *r-m*, thence broadening out to encircle cell 1st *M*, and almost completely filling cell *M*, wing-apex slightly paler brown, but this relatively broad and well-defined; veins black. Venation: *Rs* long, feebly angulated at origin, *R*, very short; cell *M* a little longer than its petiole; *m-cu* near mid-length of the lower face of cell 1st *M*; vein 2nd *A* unusually sinuous, at apex perpendicular to margin.

Abdomen blue-black, the sternites somewhat paler; genital segment and ovipositor orange, the valves of the latter exceedingly long and slender, almost straight.

*Hab.* New Zealand (South Island).

*Holotype*, Nelson (Glen), Nelson, October 22, 1923 (*E. S. Gourlay*); collector's number 35 b.

*Paratypes*, 2 ♀ ♀, Aniseed Valley, Nelson, December 1-4, 1923 (*A. Tonnoir*).

*Gynoplistia serrulata* would appear to be most closely related to *G. clavipes*, Edwards, from which it differs in the broad white annulus on each posterior tibia.

*Gynoplistia flavohalterata*, sp. n.

General coloration shiny black; antennæ 15-segmented, in the ♂ with eight branched segments; halteres uniformly yellow; wings subhyaline with a very sparse brown pattern; abdomen blue-black, the genital segment in both sexes fulvous; male hypopygium with the gonapophyses expanded at tips into small blades; ædeagus short, with a conspicuous shoulder on either side.

*Male*.—Length about 6·5 mm. ; wing 7·5–8·2 mm. <sup>✓</sup>overon

*Female*.—Length 8·7–9 mm. ; wing 8 mm. <sup>✓</sup>overon

Rostrum shiny black ; palpi brownish black. Antennæ black throughout, 15-segmented, the formula in the ♂ being 2+2+6+5, in the ♀ 2+7+6 ; branches in ♂ very elongate, the longest fully half the length of the flagellum ; terminal flagellar segment only a trifle longer than the penultimate ; in the ♀ the branches are reduced to mere serrations as in *G. serrulata*, sp. n. ; branches of flagellar segments 6 and 7 being merely indicated as a protuberance near the apex of each. Head shiny coal-black.

Prothorax and mesothorax shiny greenish black. Pleura black with an extensive patch of appressed silvery-white pubescence, occupying the anepisternum and encroaching posteriorly on the pteropleurite. Halteres uniformly yellow. Legs with the coxæ shiny yellowish brown to brownish yellow, the fore coxæ a trifle darker ; legs long and slender ; femora yellow, the tips broadly blackened, on the fore legs the black including the distal three-fifths, on the posterior legs less than the distal half ; tibiæ black, the posterior tibiæ brown, passing into black only at the narrow tips ; tarsi black. Wings subhyaline with a very sparse brown pattern ; cell *Sc* dark ; stigma oval, brown ; narrow brown seams along cord and outer end of cell 1st *M*<sub>2</sub> ; a small spot at origin of *Rs* and another of subequal size in alignment with it in the outer end of cell 1st *A* ; wing-apex broadly but rather vaguely darkened, the amount of darkening variable ; veins black. Venation : *Rs* strongly angulated at origin ; *r* close to tip of *R*<sub>1</sub> ; cell *M*<sub>1</sub> subequal to or shorter than its petiole ; *m-cu* before mid-length of cell 1st *M*<sub>2</sub> ; vein 2nd *A* rather strongly sinuous.

Abdomen blue-black, the hypopygium conspicuously brownish fulvous. Male hypopygium somewhat similar to *G. clavipes*, Edwards, in structure, differing notably in the details. Basistyle produced apically into a single flattened blade that is directed strongly mesad as well as caudad, its apex very obtuse, the tip glabrous for more than one-half its length ; interbasal process a flattened blade that is directed caudad, broadly expanded at base, thence narrowed into a neck, the apex finally dilated into a flattened head. Gonapophyses long and slender, narrowed basally, expanded at apices into a small spatula. Ædeagus short with a very conspicuous angular shoulder on either side. Ovipositor with the basal segment dull fulvous, the valves yellowish horn-colour, very long and slender, nearly straight.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Arthur Tableland, Nelson, altitude 4500 feet, December 27, 1921 (*A. Tonnoir*); collector's number 36.

*Allotopotype*, ♀.

*Paratopotypes*, 2 ♂♂, 2 ♀♀, December 25-27, 1921.

*Gynoplistia flavohalterata* is allied to both *G. clavipes*, Edwards, and *G. serrulata*, sp. n., differing in the diagnostic characters given above.

*Gynoplistia campbelli bicornis*, subsp. n.

*Male*.—Length about 6.5 mm.; wing 6.7 mm.

*Female*.—Length about 7.6 mm.; wing 8 mm.

Generally similar to typical *campbelli*, Alexander, differing as follows:—

♂. Legs with the femora less extensively blackened, on the posterior legs including only a little more than the enlarged distal third. Wings with *Sc*<sub>1</sub> ending a short distance before the fork of the long *Rs*; distal end of outer section of vein *R*<sub>1</sub> upcurved; cell 1st *M*<sub>2</sub> elongate-rectangular, *m-cu* before mid-length. Male hypopygium much as in the typical form; interbasal process bispinous, the lateral apical angle with an acute spine that is directed caudad, the mesal apical angle with a slightly larger spine that is directed mesad as in the typical form. The gonapophyses have the apical spine a prolongation of the mesal edge.

♀. The female differs rather conspicuously from the male, but seems to be correctly associated despite the differences in coloration. Since no females of the *campbelli* group have been described, more details of this sex are given:—Head shiny black. Antennæ with about the basal eight segments serrulate, the longest serration fully equal in length to the segment; terminal segments broken. The conspicuous paired tubercles on the ventro-lateral portions of the cervical sclerites are very conspicuous, directed ventrad. Pronotum black. Mesonotum shiny brown, the centres of the scutellum and postnotum narrowly darkened; postnotal pleurotergite blackened. Pleura shiny chestnut-brown, the pubescence as in the male, but nearly concolorous with the integument and correspondingly inconspicuous. Legs with the femoral tips restrictedly darkened. Wings with the apex but faintly and restrictedly infumed. Abdomen shiny blue-black, the genital segment and ovipositor orange. Ovipositor with the tergal valves elongate, very slender, the tips gently upcurved.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Waiho, Westland, altitude 600 feet, January 25, 1922 (*A. Tonnoir*); collector's number 35.

*Allotopotype*, ♀, January 21, 1922 (*A. Tonnoir*).

*Gynoplistia dispiloides*, sp. n.

Allied to *G. hyalinata*, Alexander; antennæ only 13-segmented, with nine branched segments; no silvery pubescence on thoracic pleura; halteres with dark knobs; posterior tibiæ with an obscure whitish ring; vein  $R_2$  long and sinuous.

*Male*.—Length about 4.3–4.5 mm.; wing 5.5–6 mm.

Rostrum black; palpi dark brown. Antennæ 13-segmented, the formula being  $2+2+7+2$ ; branch of the first flagellar segment about three and one-half times the segment, that of the second segment fully four times; longest branch (flagellar segments 4 and 5) a little more than one-half the flagellum; branch of flagellar segment 9 nearly twice the segment; terminal segment much larger than the penultimate. Head shiny coal-black.

Thorax entirely shiny coal-black, the pleura without evident pubescence. Halteres brownish yellow to brown, the knobs dark brown. Legs with the coxæ obscure brownish yellow, the fore coxæ more darkened basally; trochanters obscure yellow; trichiæ of legs long and conspicuous; femora yellow, the enlarged tips blackened, more extensively and conspicuously on the posterior femora; tibiæ dark brown, the tips blackened, the posterior tibiæ pale brown basally, with a broad dirty white ring beyond mid-length, the tips black; tarsi black. Wings subhyaline, the cells beyond the cord distinctly darker; stigma and a broad seam extending to  $r-m$  darker brown; very narrow and indistinct seams along cord and outer end of cell 1st  $M_2$ ; cell  $Sc$  a little infumed; veins dark brown. Venation:  $Sc_2$  longer than  $Sc_1$ , extending to opposite or beyond three-fourths  $R_3$ , the latter short, arcuated to weakly angulated and spurred at origin;  $r$  more than twice its length from tip of  $R_1$ ; cell 2nd  $R_1$  constricted near mid-length;  $R_{2+3}$  variable, from about two-thirds to a little longer than the basal deflection of  $R_{4+5}$ ; vein  $R_2$  long and sinuous, from four to five times  $R_{2+3}$  alone; cell  $M_1$  varying from subequal to nearly three times its petiole;  $m-cu$  before mid-length of cell 1st  $M_2$ ; vein 2nd  $A$  unusually straight.

Abdomen black, including the hypopygium. Male hypopygium very similar in its general structure to that of *G. hyalinata*. Basistyles with the mesal face produced

cephalad and less evidently caudad into obtuse lobes, the entire face with conspicuous setæ. Outer dististyle with the apical third much narrowed, the apex weakly serrulate. Gonapophyses appearing as very long narrow blades, the tips very narrow and subacute. *Ædeagus* with three strong setæ along each lateral margin, the outermost very long and powerful, the middle one about one-half this length, the third seta basal in position, smallest. In *hyalinata* there are two setæ of nearly equal size.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Aniseed Valley, Nelson, December 1-4, 1923 (*A. Tonnoir*); collector's number 42.

*Paratypes*, 2 ♂ ♂, Nelson, Nelson, December 8-15, 1921 (*A. Tonnoir*).

Despite its general appearance, *G. dispiloides* seems to be more closely related to *G. hyalinata*, Alexander, than to the other members of the *dimidiata* group, which includes *G. dimidiata*, Alexander, *dispila*, Alexander, *hyalinata*, Alexander, *lobulifera*, Alexander, and very probably *G. albicincta*, Edwards.

*Gynoplistia nematomera*, sp. n.

General coloration shiny black; antennæ 14-segmented, with only eight branched segments; knobs of halteres yellow; legs long and slender; wings with a very broad cross-band at the cord; male hypopygium with the basistyle produced into a long slender apical point; gonapophyses very long, filiform.

*Male*.—Length about 4.4 mm.; wing 4.8 mm.

Rostrum black; palpi dark brown. Antennæ relatively elongate, if bent backward extending approximately to the base of the abdomen, 14-segmented, the formula being  $2+2+6+4$ ; longest branch about two-fifths the flagellum; scapal segments brown; flagellar segments beyond the basal two or three, including the branches, brownish black. Head shiny black.

Pronotum and mesonotum shiny black. Pleura and sternum shiny black, without evident pubescence. Halteres brownish yellow, the knobs clear yellow. Legs unusually long and slender, the femora enlarged at apices; coxæ pale yellow, the fore coxæ blackened, except at the tips; trochanters yellow; femora obscure brownish yellow, the enlarged apices conspicuously brownish black; tibiæ and tarsi brownish black. Wings subhyaline, the apex very indistinctly but rather broadly infuscated; a very broad cross-band completely traverses the wing at the cord, most

of it lying beyond the cord-level and including the stigma ; this band is nearly parallel-sided, encircling the pale cell 1st  $M_2$  ; a conspicuous quadrate area at origin of  $Rs$  in cell  $R$ , and another slightly larger one in alignment with it in cells  $Cu$  and 1st  $A$ , near the tip of vein 2nd  $A$  ; cells  $C$  and  $Sc$  scarcely darkened ; veins dark brown. Venation :  $Sc_1$  and  $Sc_2$  ending opposite the fork of  $Rs$  ;  $Rs$  long, angulated at origin ;  $r$  about its own length from tip of  $R_1$ , cell 2nd  $R_1$  being long ; cell  $M_1$  about equal to its petiole ;  $m-cu$  just before mid-length of cell 1st  $M_2$  ; vein 2nd  $A$  unusually straight.

Abdomen black, including the hypopygium ; sternites a trifle paler. Male hypopygium with the caudal margin of the ninth tergite produced into a broad, obtusely rounded median lobe, its caudal margin with a minute U-shaped notch. Basistyle relatively stout, the apex produced caudad and slightly mesad into a long slender rod that is only a little shorter than the inner dististyle, the base of this prolongation with a few powerful setæ, the apical half or a trifle less narrowed to a slender glabrous point, the tip subacute ; outer face of basistyle with relatively few setæ, the mesal face with a dense cushion of long yellow bristles ; interbasal plate appearing as a flattened beak-like portion near the caudal mesal angle of basistyle. Outer dististyle an unusually broad-based flattened blade that narrows to a slender slightly curved point, this style without setæ. Inner dististyle a little shorter, the apex a slightly dilated obtusely rounded lobe, the style with two long setæ and several microscopic spinulæ on the distal third. Gonapophyses very long and slender, the base broader, the distal third narrowed into a filamentous portion that is weakly sinuous. *Ædeagus* broad-based, the apex unusually short and broad. Anal tube densely covered with short setæ.

*Hab.* New Zealand (North Island).

*Holotype*, ♂, Day's Bay, Wellington, November 29, 1921 (*A. Tonnoir*) ; collector's number 38.

*Gynoplistia nematomera* superficially resembles *G. trifasciata*, Edwards, but is a very different fly.

*Molophilus abruptus semiermis*, subsp. n.

*Male*.—Length about 3.2 mm. ; wing 4.6 mm.

Closely allied to the typical *abruptus*, Alexander, differing in the structure of the male hypopygium.

The basal dististyle is formed generally as in *abruptus*, with a dense group of spines near mid-length on mesal face ; here the spines are not distributed over so great an area and



are more crowded, the most distal one larger and more powerful than the others, the most basal spine short, from a slightly enlarged base. Beyond this armed portion the style narrows gradually to an acute tip that is not further armed with spines.

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Lake Brunner, Westland, February 3, 1922 (*A. Tonnoir*); collector's number 179.

*Macromastix tenuifrons*, sp. n.

General coloration orange-fulvous; antennæ short in both sexes; frontal prolongation of the head long and slender; wings subhyaline, the costal region more yellowish; stigma conspicuous, brown; cell 1st  $M_2$  unusually small, pentagonal.

*Male*.—Length about 9 mm.; wing 12–12.8 mm.

*Female*.—Length about 12 mm.; wing 14 mm.

Frontal prolongation of the head very long and slender, equal in length to the remainder of the head; nasus lacking; frontal prolongation orange-yellow, more or less suffused with brown; palpi dark brown. Antennæ relatively short, not much longer than the frontal prolongation of the head; scapal segments obscure fulvous; flagellum brown; flagellar segments gradually decreasing in size and length. Head clear fulvous-yellow.

Thorax orange-fulvous, the interspaces paler; pleura more yellow. Halteres pale brown, passing into darker on the knobs. Legs with the coxæ and trochanters orange-fulvous; femora brown, the tips narrowly blackened; tibiæ brown, darker apically; tarsi dark brown. Wings subhyaline, cells *C* and *Sc* more saturated yellow, especially the latter cell; wing-apex a very little darker; stigma conspicuous, brown; veins brownish black. Venation: *Rs* approximately equal to  $R_{2+3}$ ; *r* faint but evident, near the extreme tip of  $R_1$ , so cell 2nd  $R_1$  is very small; cell 1st  $M_2$  unusually small, pentagonal; *m* a little shorter than petiole of cell  $M_1$ ; cell 2nd *A* moderately narrow.

Abdomen yellowish brown; central portions of tergites at base darkened to form an interrupted vitta; subterminal segments and hypopygium passing into uniform dark brown.

*Hab.* New Zealand (North Island).

*Holotype*, ♂, Whangarie, North Auckland, February 22, 1924 (*T. R. Harris*).

*Allotopotype*, ♀.

*Paratopotypes*, 12 ♂ ♀ ; *paratypes*, 5 ♂ ♀ , Nihotapu, Auckland, February 24–25, 1923 (*A. Tonnoir*).

*Macromastix tenuifrons* is very distinct from all other described species of the genus in the long slender frontal prolongation of the head and the small cell 1st  $M_2$ .

*Macromastix subobsoleta*, sp. n.

*Male*.—Length 9.5 mm. ; wing 12 mm. ; antenna about 5.3 mm.

Closely related to *M. mesocera*, Alexander, differing as follows :—

Antennæ proportionately a little longer and more slender. Mesonotal præscutum with the usual three stripes conspicuous, dark brown, the median stripe very indistinctly divided by a pale capillary vitta, the surface of these stripes shiny. Halteres with the knobs largely dark. Wings with the distal section of vein  $R_2$  subobsolete and nearly in alignment with the basal section ; cell 2nd  $R_1$  thus being very small and irregularly rectangular ; distal section of  $R_2$  shorter than  $r$  ; vein  $R_3$  shorter ; veins  $M_2$ ,  $M_3$ , and  $M_4$  at wing-margin but little weaker and paler than at base ; vein  $m$  about two-thirds the basal deflection of  $M_3$  ;  $m-cu$  shorter than the distal section of  $Cu_1$ .

*Hab.* New Zealand (South Island).

*Holotype*, ♂, Mt. Grey, Canterbury, in beech forest, February 23, 1924 (*J. W. Campbell*).

*Hudsonia enigmatica*, sp. n.

Female sex fully-winged ; antennæ 9-segmented ; thorax brownish testaceous, without distinct markings ; wings brownish grey, the stigma oval, darker brown.

*Female*.—Length 18 mm. ; wing 15.5 mm.

Frontal prolongation of head relatively short, arched, brownish testaceous ; nasus stout, hairy ; palpi dark brown. Antennæ 9-segmented ; basal segment of scape elongate, second segment small, cyathiform ; basal four flagellar segments larger, gradually decreasing in length and diameter outwardly, the basal two with conspicuous powerful setæ distributed over the entire length ; flagellar segments 5 and 6 small, with long setæ ; terminal segment elongate, equal to the preceding two segments taken together and presumably the result of fusion of two segments, transversely wrinkled, provided with powerful setæ ; besides the powerful bristles and delicate setæ clothing the flagellar segments, there are intermediate pale spinous setæ, broad-based, from

distinct punctures. Head brownish yellow, brighter on the orbits and the conspicuous vertical tubercle.

Mesonotum brown, more yellowish brown on the antero-median region of the præscutum, but without distinct stripes; pseudosutural foveæ conspicuous, blackened, shiny, the margins of the præscutum immediately cephalad of the foveæ likewise blackened; remainder of mesonotum shiny testaceous-brown without markings. Pleura brown, more testaceous below; dorso-pleural membrane dull ochreous-brown; ventral portion of the postnotal pleurotergite protuberant, sparsely pubescent, the apex weakly blackened. Halteres relatively elongate, pale, the knobs brown. Legs with the coxæ and trochanters testaceous-brown; femora dull yellow, the extreme tips very vaguely and indistinctly darkened; tibiæ and basal two segments of tarsi dull yellow, the extreme tips darkened; terminal tarsal segments passing into dark brown. Wings fully-developed, brownish grey, the base and costal region somewhat darker; stigma oval, brown; veins darker brown. Venation: *Sc*<sub>1</sub> preserved; *R*<sub>1</sub> subequal to *R*<sub>2+3</sub>, gently arcuated; tip of *R*<sub>2</sub> preserved but pale; *R*<sub>3</sub> gently sinuate, not produced and bent toward the wing-tip as in the subgenus *Chlorotipula* of *Macromastix*; petiole of cell *M*<sub>1</sub> nearly twice *m*, the base of the cell pointed; cell 1st *M*<sub>2</sub> pentagonal, the proximal end one-half longer than *m*; basal section of *M*<sub>4</sub> (*m-cu* of Comstock-Needham system) short, but present; cell 2nd *A* of moderate width.

Abdomen relatively elongate; tergites obscure brownish yellow, with a large but ill-defined median brown area at the base of each segment; impressed basal areas close together; sternites more or less darkened at the incisures. Ovipositor elongate, chitinized; tergal valves long and straight, more slender than the slightly higher sternal valves; tergal valves not hairy; basal shield of ovipositor large and shiny.

*Hab.* New Zealand (North Island).

*Holotype*, ♀, Ohakune, Wellington, altitude 2060 feet, January 31, 1924 (*T. R. Harris*).

*Hudsonia ænigmatica* is a species whose strict generic position is still in doubt. The long, chitinized, non-hairy ovipositor is almost identical in structure with that of the genotype of *Hudsonia* (*heterogama*, Hudson). The antennæ are reduced to a condition about equal to that of the male sex of *H. heterogama*. If the generic reference is correct, as certainly seems to be the case, the species is of great interest in being fully winged in the female sex.

LXV.—*The Reptiles and Batrachians of Gorgona Island, Colombia.* By H. W. PARKER, B.A.

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AMONG the collections brought back by the Scientific and Expeditionary Research Association's expedition in the yacht 'St. George' is a relatively large collection of reptiles and batrachians from the island of Gorgona, Colombia.

No important collections appear to have been made on this island since 1904; the reptiles and batrachians then collected have been fully reported upon by Barbour\*, but, since the majority of the species represented in the present collection have not previously been recorded from the island, it has been considered advisable to compile a complete faunal list.

All the specimens collected by the expedition have been presented to the British Museum.

LACERTILIA.

- (1) *Gonatodes fuscus* (Hall.) †.
- (2) *Gonatodes caudiscutatus* (Günth.) †.
- (3) *Lepidoblepharis intermedius*, Bouleng.

One male, an egg, and two recently hatched young. The egg and young have been described elsewhere †. The eggs were found under a coconut-leaf on July 8th, and hatched on September 15th.

- (4) *Lepidoblepharis peraccae*, Bouleng., ♂.
- (5) *Sphaerodactylus scapularis*, Bouleng., Hgr.
- (6) *Anolis gorgonæ*, Barbour †.
- (7) *Anolis fasciatus*, Bouleng., Hgr.

\* Bull. Mus. Comp. Zool. Harvard, xlv. no. 5, 1905, pp 99-102.

† Recorded by Barbour.

† Parker, Ann. & Mag. Nat. Hist. (9) xvii. 1926, p. 294

(8) *Anolis lemniscatus*, Bouleng.

♀. This lizard is apparently referable to the above species, but is scarcely distinguishable from *A. cupreus*, Hall.; a larger series of specimens may show that the two are synonymous.

(9) *Basiliscus basiliscus* (Linn.) †.(10) *Basiliscus galeritus*, A. Dum.

3 ♂♂, 1 hgr., 2 yg. It is remarkable that the sixteen specimens of *Basiliscus* recorded by Barbour should all be referable to *B. basiliscus* and the six in the present collection to *B. galeritus*.

(11) *Enyaliodes heterolepis*, Bocourt.

*Enyaliodes insulæ*, Barbour †.

3 ♂♂ and 1 yg. These specimens agree in all respects with Barbour's description of *E. insulæ*, but I am unable to distinguish them from specimens of *E. heterolepis* from Ecuador and Colombia; as, apparently, the Gorgona *Enyaliodes* is not a distinct race, *E. insulæ* must be placed in the synonymy of *E. heterolepis*.

(12) *Iguana tuberculata*, Laur.†.(13) *Ameiva bridgesi* (Cope) †.

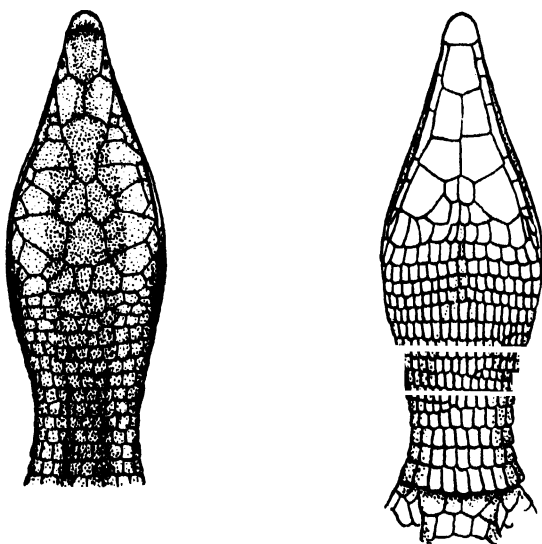
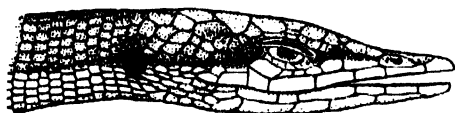
2 ♂♂, 1 hgr., 1 yg.

(14) *Anadia angusticeps*, sp. n.

Type-specimen a ♀, no. 1926. 1. 20. 122 in the British Museum.

Head depressed, with long pointed snout; body very elongate. Nostril in a single nasal; fronto-nasal pentagonal, considerably longer than broad (7:5), longer than the præfrontals which form a long median suture; frontal narrow behind, in contact with three supraoculars,  $1\frac{1}{2}$  as long as the frontoparietals, and longer than the interparietal; a large parietal on each side in contact with the interparietal; these shields followed by a median azygous and three pairs of occipitals; four supraoculars, the first smallest, the remainder subequal; five or six supraciliaries; a loreal, a freno-orbital,

and a row of infraorbitals ; seven upper labials, the first in contact with the frontonasal ; six or seven lower labials ; an anterior azygous and four pairs of chin-shields, the first two pairs in contact on the median line ; gular scales quadrangular, distinctly longer than broad (twice as long as broad in the middle region), in sixteen transverse rows from the chin-shields to the collar ; collar-scales ten, feebly enlarged.



*Anadia angusticeps*, sp. n.,  $\times 4$ .

Scales on the body in more or less regular whorls ; dorsals and ventrals quadrangular, slightly longer than broad, the ventrals slightly larger than the dorsals ; laterals smaller than the dorsals and frequently tending to break the regular whorls ; 32 scales round the middle of the body, 60 from the occiput to the base of the tail, and the ventrals in ten longitudinal series. Two anterior and four posterior preanals ; two

preanal and two femoral pores on each side. Limbs short, not meeting when adpressed; digits slender, the distal phalanges forming a slight angle with the basal. Tail elongate, rounded, and covered with equal, elongate, quadrangular scales which are arranged in whorls.

*Colour in spirit*.—Brownish grey above, indistinctly darker on the median line and the flanks; white below, the line of demarcation between the colours of the upper and lower surfaces being sharply defined. Tail above with numerous minute dark brown spots which are arranged so as to leave an indefinite lighter zigzag band dorso-laterally; beneath with a row of dark brown spots on each side.

	mm.
Total length (tail injured) .....	127
Snout to vent .....	48
Head .....	11
Width of head .....	5
Fore limb .....	10
Hind limb .....	13

In the condition of the body-scales this species approaches the genus *Euspondylus*; comparison with various species of the genera *Euspondylus* and *Anadia* shows, however, that it is most closely related to *Anadia vittata*, Boulenger, from which species it differs in its more slender form, longer snout (and consequently differently proportioned head-shields), and coloration.

## OPHIDIA.

### (15) *Phrynonax guentheri*, Bouleng.†.

♀. Ventrals 206, subcaudals 76 + *n*. This specimen differs from the type in having only eight upper labials.

### (16) *Chironius grandisquamis* (Peters).

♂. Ventrals 156, caudals 118.

### (17) *Leptophis occidentalis insularis*, Barbour †.

### (18) *Leptodeira albofusa* (Lacép.) †.

### (19) *Oxybelis brevirostris* (Cope).

♂. Ventrals 166, caudals 144 + *n*.

### (20) *Hydrus platurus* (Linn.).

† Recorded by Barbour.

(21) *Micrurus mentalis* (Bouleng.).

♀. Ventrals 291, caudals 24.

(22) *Bothrops atrox* (Linn.) †.

Four young. Ventrals 193, 193, 194, 200; caudals 60, 63, 61, 68. One of these—380 mm. in length—has in its stomach a full-grown centipede (*Scolopendra angulata*, Newport), 140 mm. long.

## BATRACHIA.

### SALIENTIA.

(23) *Phyllobates* [*Prostherapis*] *boulengeri*, Barbour †.

1 ♀ and 2 hgr. These specimens are undoubtedly referable to the above species, but they differ from previous descriptions of the species in having the skin of the dorsal surface distinctly glandular. Their colour in spirit is as follows:—Above grey-brown with a metallic lustre, marbled with darker; a dark brown band from the tip of the snout, along the loreal region, above the fore limb to the hind limb, bordered above and below by narrow white lines; the upper of these extends only from the scapular region to the groin, the lower from the tip of the snout (where it is in contact with its fellow) along the upper lip to the hind limb. Fore limb dark brown marbled with lighter, its anterior surface almost completely white. Hind limbs marbled dark and light brown, with an indefinite white stripe along the hinder side of the thighs. Under surface dirty white, with bold dark brown reticulations.

(24) *Atelopus elegans*, Bouleng.

*Atelopus gracilis*, Barbour †.

Thirteen specimens, ♂, ♀, and young. Comparison of this series of specimens with a co-type of *Atelopus gracilis* and a series of specimens of *A. elegans* from N.W. Ecuador shows that these two species cannot be regarded as distinct.

(25) *Eleutherodactylus gularis* (Boulenger).

2 ♂♂. These two specimens differ from the types of *E. gularis* in having rather slenderer digits and smaller digital discs, but do not appear to be specifically distinct.

† Recorded by Barbour.



(26) *Bufo typhonius* (Linn.).

4 hgr.

#### APODA.

(27) *Cæcilia intermedia*, Boulenger.

A single specimen.

#### CROCODILIDÆ.

(28) *Caiman sclerops* (Schneid.).

#### LXVI.—*Pisaster*, a Genus of Sea-Stars\*.

By W. K. FISHER, Hopkins Marine Station, California.

[Plates XIX.-XXIII.]

THE family Asteriidæ is represented on the Pacific Coast of North America by large and ecologically conspicuous forms, some of which occur locally in extraordinary numbers. Certain genera are peculiar to the region, as, for example, *Stylasterias*, *Astrometis*, *Lethasterias*, and *Orthasterias* in the Coscinasteriinae; *Pycnopodia* in the Pycnopodiinae; *Evasterias*, *Stenasterias*, *Pisaster*, and *Aphanasterias* in the Asteriinae †.

Among intertidal and shallow-water species, none are more in evidence than those of the genus *Pisaster*, an isolated highly-evolved group with no near relatives. A curious coincidence is the superficial resemblance between certain forms of *Evasterias troschelii* and *Pisaster ochraceus*. There is no evidence that the genera are more than remotely related, but both species have an almost identical ecology where their ranges overlap, which is from southern Alaska to Monterey, California. Both genera have specialized in an extensive actinal system of plates and a very similar abactinal skeleton. *Evasterias* is an offshoot from *Asterias* stock, but *Pisaster* is worlds removed. Possibly it is allied to *Uniophora* of Australia.

Verrill's treatment of this genus needs considerable modification in the light of much more abundant material and an acquaintance with living animals. The species are variable

\* Published with permission of the Secretary of the Smithsonian Institution.

† Fisher, "A Preliminary Synopsis of the Asteriidæ," Ann. & Mag. Nat. Hist. ser. 9, vol. xii. p. 247 (1923).

in the highest degree. For certain purposes it is desirable to recognize named formæ. These are without geographical significance, but are sometimes nearly synonymous with what have hitherto been regarded as valid species.

The most characteristic features of *Pisaster* are the furcate pedicellariæ (*vide infra*), which are unique; the broad actinal area; the long adoral carina (composed of numerous pairs of contiguous ambulacral plates) bent upward to the deeply sunken, small actinostome. These are all indications of high specialization, as are the very numerous crowded ambulacral ossicles and small mouth-plates. If we assume as primitive a type similar to *Hydrasterias* with open oral angle (*i. e.*, without adoral carina), with biserial tube-feet and uncrowded ambulacral ossicles, no actinal plates, and few regular dorso-laterals, then *Pisaster* is one of the most specialized genera in the family. It is, moreover, restricted in habitat, as specialized genera are likely to be.

Verrill\* (p. 67) lays considerable emphasis upon the large unguiculate pedicellariæ as peculiar features of this genus, but this type is widely distributed through the family and is in no way characteristic of *Pisaster* alone. The small furcate straight pedicellariæ are, however, unique, nothing closely similar to them having been described for any sea-star. Nor is mention made of them by Verrill, though they are very abundant in his *Pisaster papulosus* (= *brevispinus*) as well as in other forms, except the southern races of *P. ochraceus* and *P. giganteus*, where they are rather scarce.

In the left column are the forms recognized in this synopsis and in the right column the names which the same forms bear in Verrill's 'Shallow-water Starfishes':—

<i>Pisaster ochraceus</i> , forma <i>ochraceus</i> .	<i>Pisaster ochraceus</i> (p. 69).
— — —, f. <i>nodiferus</i> .	— — — <i>fissispinus</i> (p. 70).
— — —, f. <i>confertus</i> .	— — — <i>ochraceus</i> , var. <i>nodiferus</i> (p. 72).
— — — <i>segnis</i> .	— — — <i>confertus</i> (p. 73).
— — — <i>brevispinus</i> , f. <i>brevispinus</i> .	— — — <i>ochraceus</i> .
— — —, f. <i>paucispinus</i> .	— — — <i>brevispinus</i> (p. 77).
— — — <i>giganteus</i> .	— — — <i>papulosus</i> (p. 91).
	— — — <i>paucispinus</i> (p. 98).
	— — — <i>lutkenii</i> (p. 83).
	— — —, var. <i>australis</i> (p. 88).
	— — — <i>giganteus</i> (p. 97).
— — — <i>capitatus</i> .	— — — <i>capitatus</i> (p. 81).
	— — — <i>grayi</i> (p. 97).

\* "Monograph of the Shallow-water Star-fishes of the North Pacific Coast from the Arctic Ocean to California." Smithsonian Institution, Washington, 1914. All citations of "Verr. p. ——" refer to this work.

*Pisaster grayi*, Verrill, is a phantom species, the origin of which is traceable to a mistake in Perrier's 'Révision des Stellérides,' page 68. Perrier there described the types of Gray's *Asterias katherinæ* (= *Leptasterias polaris katherinæ*) as having monacanthid adambulacrals, whereas the types (which can be fixed with perfect precision) all have diplacanthid adambulacrals. Verrill accepted Perrier's description, but inferred that these supposedly monacanthid specimens were a second set of six-rayed asterids which Perrier had mistaken for the types of *Asterias katherinæ*. He named them *Pisaster grayi*. No such second set exists, however. *Pisaster grayi* is therefore without status. The name must be regarded as a synonym of *Leptasterias polaris katherinæ*.

### Genus PISASTER, Müller & Troschel.

*Asterias* (pars), Brandt, Prodrömus, 1835, and authors.

*Pisaster*, Müller & Troschel, Archiv f. Naturgesch. 6 Jahrg. Bd. i. 1840, p. 367; System der Asteriden, 1842, p. 20.—Type *Asteracanthion margaritifera*, M. & T. (= *Asterias ochracea*, Brandt); A. Agassiz, Mem. Mus. Comp. Zool. vol. v. 1877, p. 96 (citation); Fisher, Smithsonian Misc. Coll. vol. lli. 1908, p. 89; Zool. Anz. Bd. xxxiii. 1908, p. 358; Verrill, Amer. Journ. Sci. vol. xxviii. 1909, p. 63; Shallow-water Starfishes, etc. 1914, p. 67.

*Asteracanthion* (pars), Müller & Troschel, System der Asteriden, 1842, p. 20.

*Calliasterias*, Fewkes, Bull. Essex Inst. vol. xxi. 1889, p. 33.—Type *Asterias exquisita*, de Loria (= *Pisaster giganteus*, juv.).

**Diagnosis.**—Large, heavy-ossicled, monacanthid Asteriinae, having an irregularly reticulate abactinal skeleton; few to numerous short subcapitate abactinal spines; 2 to 5 longiseries of spiniferous actinal plates; a small, deeply sunken actinostome; long upcurved adoral carina; extremely compressed ambulacral ossicles; unique furcate straight pedicellariæ, each jaw of which ends in one long and one short hyaline blade; no pedicellariæ on adambulacral spines; gonads opening dorsally.

**Description.**—Abactinal skeleton irregularly reticulate; the carinals and marginals at first four-lobed; one or more intermarginal ossicles; in old specimens secondary ossicles are developed between consecutive infero-marginal and actinal plates as well as between the plates of the transverse series; normally two infero-marginal and one actinal spine to a plate, each with a thick pad of crossed pedicellariæ on outer side; abactinal spines variable, but uniformly short, subconical to subglobose, the more or less specialized distal portion longitudinally scored; in old specimens there may be more than five longiseries of actinal plates, and the skeleton is strengthened

by the addition of new ossicles on the cœlomic side. Actinostome small, deeply sunken, the adoral carina composed of upward of 15 pairs of contiguous adambulacral; proximal end of furrow petaloid in form; ambulacral ossicles very much compressed, so that the tube-feet stand in six rows at the widest part of furrow; interbranchial septum strongly calcified, and extending about two-thirds towards centre of disk; aperture from arm-cœlom into disk small (about twice diameter of madreporite in *ochraceus*); a series of transverse, vertical, superactinal partitions or buttresses connect the adambulacral and infero-marginal plates, the spaces between them forming a series of cœlomic cavities above the actinal plates. Papulæ numerous, slender, in clusters, the actinal very long; the clusters originate from a common hernia-like swelling of the skin, which, with bases of papulæ, is armed with tiny lanceolate pedicellariæ. Stomach eversible; pyloric cœca long, bulky; intestinal cœcum with slender irregular lobes; gonads, extensive racemose tufts, opening dorsally.

Small, furcate, straight pedicellariæ (usually mingled with the crossed) are peculiar to the genus, and consist of a basal piece, longer than broad, and two curved jaws each ending in two thin hyaline blades, characteristic for each species. One blade is always much longer and broader than the other. Large, sessile, ovoid, "stone-hammer" pedicellariæ with narrow to broad-ovate jaws and terminal interlocking teeth are found scattered over the body, but especially in the intermarginal and in the actinal interradiial channels; very small, lanceolate, dermal, straight pedicellariæ are common, especially among the papulæ and in long pedunculate clusters attached to the furrow-margin, often surrounding one or more large, lanceolate, toothed pedicellariæ. Crossed pedicellariæ, in dermal tufts or surrounding spines, are numerous, and lack any conspicuously enlarged terminal teeth.

*Pisaster ochraceus* (Brandt).

*Asterias ochracea*, Brandt, Prodröm, 1835, p. 69 (Sitka); Stimpson, Boston Journ. Nat. Hist. vol. vi. 1867, p. 527, pl. xxiii. fig. 2; Verrill, Trans. Conn. Acad. Sci. vol. i. 1867, pp. 325, 326; Perrier, Révision des Stell. 1875, p. 70; Whiteaves, Trans. Royal Soc. Canada, vol. iv. 1887, p. 116; Agassiz, Mem. Mus. Comp. Zool. vol. v. 1877, p. 96, pl. xi. figs. 1-7; Sladen, 'Challenger' Asteroidea, pp. 566, 526; H. L. Clark, Bull. Mus. Comp. Zool. vol. li. 1907, p. 67, pl. vi. fig. 3.

*Asterias janthina*, Brandt, Prodröm, 1835, p. 69 (Sitka).

*Asteracanthion margaritifera*, Müller & Troschel, System der Asteroidea, 1842, p. 20 (Sitka P).

- Asterias conferta*, Stimpson, Proc. Boston Soc. Nat. Hist. vol. viii. 1862, p. 263 (Puget Sound); Verrill, Trans. Conn. Acad. Sci. vol. i. 1867, p. 326; Perrier, Revision des Stell. 1875, p. 71; Sladen, 'Challenger' Asteroidea, 1889, pp. 566, 820; Bell, Proc. Zool. Soc. 1881, p. 494; Whiteaves, Trans. Royal Soc. Canada, vol. iv. 1887, p. 116; De Loriol, Mém. Soc. Phys. et Hist. Nat. Genève, vol. xxxii. pt. 2, 1897, p. 171, pl. iii. figs. 1-1 g.
- Asterias fissispina*, Stimpson, loc. cit. p. 264 (Shoalwater Bay, Washington); Verrill, Trans. Conn. Acad. Sci. vol. i. 1867, p. 326.
- Pisaster* [*Pisaster*] *ochraceus*, Verrill, Amer. Journ. Sci. vol. xxviii. 1909, p. 63.
- Pisaster ochraceus*, Fisher, Smiths. Misc. Coll. vol. lii. 1908, p. 80; Verrill, Amer. Nat. vol. xliii. 1909, pp. 542, 544, 548; Shallow-water Starfishes, 1914, p. 69, pl. xxi. figs. 1, 2; pl. xlix. figs. 3-3 d; pl. lvi. figs. 3, 3 a; H. L. Clark, Bull. Amer. Mus. Nat. Hist. vol. xxxii. 1913, p. 203 (San Diego).
- Pisaster ochraceus*, var. *nodiferus*, Verrill, loc. cit. p. 72, pl. lvi. figs. 3, 3 a (Monterey to Sitka).
- Pisaster* [*Pisaster*] *confertus*, Verrill, Amer. Journ. Sci. vol. xxviii. 1909, p. 63.
- Pisaster confertus*, Verrill, Shallow-water Starfishes, 1914, p. 73, pl. xxxviii. figs. 1, 2; pl. liii. fig. 2.
- Pisaster fissispinus*, Verrill, loc. cit. p. 76, pl. xxxix. figs. 1, 2.

*Diagnosis*.—A usually thick-rayed *Pisaster* with numerous small subcapitate, striated, abactinal spines arranged in a very irregular reticulate pattern on dorsal and lateral surface of rays, or in detached convex groups, especially on outer part of ray. Actinal spines longer than the abactinals, clavate, striate, in upward of six longitudinal series. Furcate pedicellariæ with the undivided basal portion of jaw about equal in length to the longer of the two hyaline blades (which has the upper edge decidedly uneven in most cases).

In this brief synopsis no account of the numerous variants can be undertaken. Nor is even a composite description of the species possible. The three fairly well-marked formæ freely intergrade.

**Forma *ochraceus* (Brandt).** (Pl. XIX. figs. 1, 1 a;  
Pl. XX. fig. 4, Sitka; Verr., pl. xxi.)

This form stands between *confertus* with small spinelets and *nodiferus* characterized by stout, subglobose, abactinal tubercles in more or less isolated convex groups or heaps. It is assumed to be the typical form and was so regarded by Stimpson when he described *confertus* as a distinct species. The only specimens of *ochraceus* from Sitka, the type-locality, examined by me (Pl. XX. fig. 4) are referable to this forma. But *Asterias janthina*, Brandt, also described from Sitka, is very likely the common purple phase of *confertus* so conspicuous at Departure Bay, B.C.

The abactinal spines are small, but tubercular, with sub-

globose striate ends, arranged usually in single file, sometimes by twos, or in small groups at the nodes, to form a very irregular but fairly continuous, open net defining the sunken papular areas, which in life are crowded with papulæ and cushions of crossed and furcate pedicellariæ.

An average specimen from Monterey Bay measures R 140 mm., r 40 mm., breadth of ray at base 40 mm.

Colour in life: yellow-ochre, yellow-brown, pale reddish brown, dark brown, dark purplish brown.

Type-locality: Sitka, Alaska.

The form typical of open sea coast, Sitka, Alaska, to Point Sal, California.

The type of Stimpson's *Asterias fissispina* is an individual variation of this forma, in which the actinal spines are bifid or malformed at the tips. The furcate pedicellariæ are typical of *ochraceus*.

*Forma confertus* (Stimpson). (Pl. XX. fig. 1 ;  
Verr., pl. xxxviii.)

*Asterias conferta*, Stimpson ; *Pisaster confertus*, Verrill.

This form is characterized by smaller and frequently more numerous abactinal spines than are found in typical *ochraceus*, with which it freely intergrades. The abactinal spinelets are only about 0.8 or 0.9 mm. long and relatively slender. Some specimens carry 3 to 8 spinelets on most of the carinal and apical plates. Other specimens have the spinelets in single file or with the slight irregularity in number normal to *ochraceus*. The supero-marginal plates usually carry three or four spinelets, giving the armature a different and more crowded appearance than that of *ochraceus*. In some cases the actinal spines are slightly slenderer than those of *ochraceus*; in others there is no difference, and I am unable to find any constant actinal features by which *confertus* can be distinguished from *ochraceus*.

Colour in life: purple, the small spines whitish; less often vinaceous-rufous or madder-brown.

Type-locality: Puget Sound, Washington.

This form is practically confined to the quiet bays and sounds of Washington, British Columbia, and Southern Alaska. A natural inference is that the characteristic small spinelets of the abactinal area are correlated with quiet water. Specimens of *ochraceus* and *nodiferus*, both characteristic of the open coast, are, however, sometimes taken along with *confertus* and intermediates.

Forma *nodiferus*, Verrill. (Pl. XX. fig. 3 \* ;  
Verr., pl. lvi. fig. 3.)

*Pisaster ochraceus*, var. *nodiferus*, Verrill.

Abactinal spines stout, globose, or depressed-globose, finely striated, larger than in forma *ochraceus* and congregated in well-separated convex groups or heaps, three or four to a dozen unequal or subequal tubercles to a group. In the centre of the disk there is usually a well-defined stellate palisade surrounding a central group of tubercles, and from the points of the star a carinal series of tubercles often extends half the length of the ray, but as often is entirely absent or represented here and there by unequal tubercles. The spaces between the groups are usually entirely free from spines, or in intermediate forms have more or less reticulation at base of ray and more complete isolation and prominence of the groups distally. Crossed pedicellariæ 0.3 to 0.36 mm. long are a little longer than in forma *ochraceus* (0.25 to 0.27 mm.).

The young of forma *ochraceus* are frequently forma *nodiferus*.

Type-locality: none given.

Southern Alaska to Monterey, thence to northern Lower California (south of Santa Barbara, belonging to the following race).

*Pisaster ochraceus segnis*, subsp. n. (Pl. XX. fig. 3.)

*Diagnosis*.—Differing from typical *ochraceus* in having relatively few furcate straight pedicellariæ and conspicuously larger crossed pedicellariæ.

This is the Southern Californian representative of *Pisaster ochraceus*, and it parallels exactly *Pisaster giganteus capitatus*, which also has larger crossed pedicellariæ and much fewer furcate pedicellariæ than its northern relative. Both forma *ochraceus* and *nodiferus* extend continuously to northern Lower California, the latter predominating, apparently, at Laguna Beach, Orange County (Pl. XX. fig. 3). The differences enumerated in the diagnosis apply to both formæ.

The crossed pedicellariæ measure as follows: forma *nodiferus*, length 0.36 to 0.41 mm.; forma *ochraceus*, 0.35 to 0.36 mm. Comparable specimens from Monterey to Sitka: forma *nodiferus*, 0.30 to 0.36 mm.; forma *ochraceus*, 0.25 to 0.27 mm.

\* This is a specimen of the southern race *segnis*, from Laguna Beach, California.

Superficially this race is indistinguishable from true *ochraceus*.

Type. No. E 1238, U.S. Nat. Museum; paratype in the British Museum (Nat. Hist.).

Type-locality: Lower California, 16 miles south of International Boundary.

Santa Barbara to Northern Lower California.

*Pisaster giganteus* (Stimpson). (Pl. XIX. figs. 2, 2 a, b;  
Pl. XXI. figs. 1, 2; Verr., pls. xxxvii. xl.)

*Asterias gigantea*, Stimpson, Boston Journ. Nat. Hist. vol. vi. 1857, p. 528, pl. xxiii. figs. 4, 5, 6 (Tomales Bay, Calif.); Verrill, Trans. Conn. Acad. vol. i. 1867, p. 327.

*Asterias lutkeni*, Stimpson, Proc. Boston Soc. Nat. Hist. vol. viii. 1862, p. 265 (California or Oregon); Verrill, 1867, p. 32; Perrier, Révision, 1875, p. 70; Bell, Proc. Zool. Soc. London, 1881, p. 495; Sladen, 'Challenger' Asteroidea, 1889, p. 566, 824; De Loriol, Mém. Soc. Phys. et Hist. Nat. Genève, vol. xxxii. 1897, p. 15, pl. ii. [17], figs. 1 1 h (Vancouver Island).

*Asterias exquisita*, de Loriol, Rev. Zool. Suisse, vol. iv. 1888, p. 403, pl. xviii. fig. 2 (young specimen, Santa Cruz, Cal.).

*Calliasterias exquisita*, Fewkes, "Zoological Excursions. -I. New Invertebrata from the Coast of California," Bull. Essex Inst. vol. xxi. 1889, p. 33.

[*Pisaster*] *lütkeni*, Verrill, Amer. Journ. Sci. vol. xxviii. 1909, p. 63; Amer. Nat. vol. xliii. 1909, p. 543.

*Pisaster lutkenii*, Fisher, Smithsonian Misc. Coll. vol. lii. 1908, p. 89; Verrill, Shallow-water Starfishes, 1914, p. 83, pl. xl. figs. 1, 2.

*Pisaster lütkenii*, var. *australis*, Verrill, loc. cit. 1914, p. 88 (off Pacific Grove, California, not San Diego).

[*Pisaster*] *giganteus*, Verrill, Amer. Journ. Sci. vol. xxviii. 1909, p. 63.

*Pisaster giganteus*, Verrill, Amer. Nat. vol. xliii. 1909, p. 545; Shallow-water Starfishes, 1914, p. 89, pl. xxxvii. figs. 1, 2.

*Diagnosis*.—Rays 5 or 6; size sometimes very large with R over 300 mm. A typical *Pisaster*, differing from *ochraceus* in having less numerous and longer, solitary, terminally swollen, subconic to subglobose, coarsely striated spines, rather uniformly spaced over the abactinal surface, never in close ranked lines forming a reticulate pattern nor in acorvate heaps; base of spine surrounded by a zone of bare skin, blue in life, fringed by numerous crossed and furcate pedicellariæ; stone-hammer-shaped, large pedicellariæ abundant to scarce. The giant type measures R about 304 mm., r 73 mm., R=4.1r. A characteristic intertidal example from Monterey measures R 123 mm., r 30 mm., R=4.1r; breadth of ray at base, 31 to 33 mm. Disk rather high; ray, subcylindrical in section, slightly flattened actinally, and capable of slight inflation at base.

Two extremes of variation, representing recognisable



formæ, are connected by every shade of intergradation, the intergrades being fully as numerous as the extremes. One has more widely spaced, less numerous, abactinal spines, which are usually more obtuse or subglobose terminally. The other or typical form has numerous slenderer spines with more elongate, swollen tips, acorn-shape, subglobose, obtuse conic, or sub-cylindrical. Their coarse longitudinal furrows give them the appearance of tiny drills, and they vary widely in form even on the same ray. Examples from Monterey with more widely spaced spines have been mistaken for *capitatus* (Verr. p. 83).

The type-specimen is a veritable giant with six rays, the radii being 304 and 73 mm. At Monterey giant specimens of both the slenderer and heavier spined formæ occur, usually off shore, while medium-sized examples are found sparingly in tide-pools.

This species has been known as *Pisaster lütkenii*, but there is no doubt that Stimpson's earlier *Asterias gigantea*, the type of which I have studied, is the same species. Verrill's *Pisaster lütkenii*, var. *australis*, stated to be from San Diego, is in reality based upon a specimen from Monterey. A loose label bearing the inscription "San Diego, Dr. Edward Palmer" became associated with the type, which fortunately still bears an inconspicuous tag, securely pasted to one ray, inscribed "W. R. Coe, 1901." Dr. Coe obtained the specimen at the old Hopkins Seaside Laboratory, Monterey Bay. *Australis* is therefore but one of the numerous variants of *giganteus*.

Colour in life: abactinal spines white surrounded by a conspicuous zone of bright to dull blue integument; general tint brown, the papular areas raw sienna; actinal surface, including infero-marginal spines, yellowish white with pale greyish-green papulæ; tube-feet Capucine buff.

Type-locality: Tomales Bay, California.

Southern part of Vancouver Island to Monterey Bay, intergrading at the south with *P. giganteus capitatus*. Low tide to 48 fathoms.

*Pisaster giganteus capitatus* (Stimpson).  
(Verr., pl. xxxvi. figs. 3, 4; pl. lvi. fig. 4.)

*Asterias capitata*, Stimpson, Proc. Boston Soc. Nat. Hist. vol. viii. 1862, p. 264; Verrill, Trans. Conn. Acad. Sci. vol. i. 1867, p. 327; Perrier, Révision, 1875, p. 71; Sladen, 'Challenger' Asteroidea, 1880, pp. 566, 820.

[*Pisaster*] *capitatus*, Verrill, Amer. Journ. Sci. vol. xxviii. 1909, p. 63.  
*Pisaster capitatus*, C. F. Baker, First Annual Report of Laguna Marine Laboratory, (1912) p. 89; Verrill, Shallow-water Starfishes, 1914, p. 81, pl. xxxvi. figs. 3, 4; pl. lvi. fig. 4.

*Diagnosis.*—Differing from *Pisaster giganteus* in having typically fewer and generally stouter abactinal spines, larger crossed pedicellariæ, and very few furcate bilaminate straight pedicellariæ. Rays 5, rarely 6. R 190 mm., r 52 mm.; rays inflated, abactinal spines stout, widely spaced, subconical; larger circumspinal collars 8 to 10 mm. broad. Narrow-rayed form (Venice, Cal.), R. 170 mm., r 40 mm., width of circumspinal collars, 5 mm.

Both formæ of *giganteus* are included in the race *capitatus*. The type belongs to the heavier spined forma. In southern California extremes of this forma have fewer and heavier spines than the northern equivalent. An example from San Diego with R 140 mm. has only two dorso-lateral series of spines, irregularly aligned (about five longiseries between the supero-marginals), while a specimen from Laguna Beach (R 180 mm.) has the equivalent of nine series (without serial alignment). The spines are widely spaced with broad collars of bare skin fringed by a circular ruff of crossed pedicellariæ. The space between the spines may reach 10 or 12 mm. The spines are strongly capitate, robust, with ornately grooved subglobular to acorn-shaped ends, and are seated rigidly on convex plates of the very irregular skeleton.

The other forma, or extreme, has narrower rays and more numerous, generally slenderer, sometimes quite unequal abactinal spines. There is little to distinguish it from some specimens of true *giganteus* (with which Verrill confused it), except the characters of the pedicellariæ specified in the diagnosis. One may count from 9 to 15 spines across the ray between the two supero-marginal series. There is complete intergradation between the two extremes in a good series from Venice, California. At Laguna Beach the specimens are all of the heavy-spined forma. Length of crossed pedicellariæ 0.4 to 0.45 mm. (Laguna Beach; San Diego). Length of comparable pedicellariæ of *giganteus* from Monterey, 0.27 to 0.31 mm.

Type-locality: San Luis Obispo Bay, California.

San Luis Obispo Bay to Northern Lower California, intertidal and shallow water.

By a curious mistake the type-locality is stated by Stimpson to be "San Diego, California. Colorado Expedition. Dr. J. S. Newberry." The type-specimen, No. 1280, U.S. National Museum, is labelled in Dr. Stimpson's well-known hand-writing, "*Asterias capitata*, Stm. San Luis Obispo. Dr. Newberry." This is undoubtedly correct, as it can be ascertained that Dr. Newberry did not collect at San Diego.

It is unfortunate that he did not do so, for the type is

really intermediate between *giganteus* and *capitatus*. The abactinal spines are of the large, capitate, well-spaced sort, characteristic of *capitatus* from further south, but the crossed pedicellariæ are too small and the furcate pedicellariæ are too numerous. The large crossed pedicellariæ measure 0.36 mm. (0.4 mm. in *capitatus*; 0.31 mm. in *giganteus*). On the whole, however, the type really "favours" *capitatus*.

*Pisaster brevispinus* (Stimpson).

*Asterias brevispina*, Stimpson, Boston Journ. Nat. Hist. vol. vi. 1857, p. 528, pl. xxiii. fig. 3 (San Francisco Bay, California).

*Asterias paucispina*, Stimpson, Proc. Boston Soc. Nat. Hist. vol. viii. 1862, p. 266 (Puget Sound); Perrier, Rév. Stell. 1875, p. 60.

*Asterias (Pisaster) papulosa*, Verrill, Amer. Journ. Sci. vol. xxviii. July 1909, p. 63 (Puget Sound).

*P[isaster] brevispina*, Verrill, loc. cit. p. 63.

*Pisaster brevispinus*, Verrill, Shallow-water Starfishes, 1914, p. 77, pl. xli. figs. 1, 2; pl. xlv. figs. 1, 2; pl. xlv. fig. 1; pl. lxix. fig. 3; pl. lxxvi. figs. 1-1 b.

*Pisaster papulosa*, Verrill, loc. cit. p. 91, pl. xlii. fig. 1; pl. xliii. fig. 1; pl. lx. fig. 1; pl. lxxvi. figs. 2-2 d; pl. lxxx. fig. 4.

*Pisaster* ? *paucispinus*, Verrill, loc. cit. p. 98, pl. xxxvi. figs. 1, 2.

*Diagnosis*.—Differing from *P. ochraceus* in its rose-pink coloration; papular areas grey-green or maroon-purple; dorso-lateral spines not forming a reticulated pattern (except occasionally in forma *brevispinus*), but standing singly or in small groups; often few in number; furcate pedicellariæ of characteristic form with upper margin of jaw smooth, not crenulate. Rays 5. A giant specimen of forma *brevispinus*, R 320 mm., r 66 mm.; one of forma *paucispinus* R. 115 mm., r 60.

The most obvious variation in this species is in the abundance of abactinal spines upon which the two freely intergrading formæ are based.

Forma *brevispinus*, Stimpson. (Pl. XIX. figs. 3, 3 a; Pl. XXII. figs. 1, 2; Verr., pl. xli., type.)

*Asterias brevispina*, Stimpson; *Pisaster brevispinus*, Verrill.

In this forma belong those individuals having dorso-lateral spines typically in small groups or clusters, spaced without regular order between the carinals and the supero-marginals. There is a great variation in the number of groups and number of spines per group. The spines, coarse and capitate, vary from 3 or 4 to 8 or 10 per group. In extreme cases the carinal spines are crowded in transverse groups on the plates, so as to form a conspicuous radial band. In a less

pronounced phase the dorso-lateral spines stand singly or in small groups of 2 to 5 and are slenderer, and the end is frequently subconical with a subacute or rounded tip. The carinal spines frequently are in a single longiseries, and not in a longiseries of groups or short transverse rows. These differ from typical specimens of *paucispinus* in having the equivalent of at least three dorso-lateral longiseries of dorso-lateral spines.

Large dentate pedicellariæ of numerous sizes up to 2.5 mm. (exceptionally, 4 mm.) long are sometimes very abundant.

Colour in life: rose-pink, the papular areas dark sage-green or maroon-purple.

Type-locality: San Francisco Bay.

Puget Sound region, Washington, to Monterey Bay.

Forma *paucispinus* (Stimpson). (Pl. XIX. fig. 3 b; Pl. XXIII. figs. 1-4; Verr., pls. xlii., xliii. (*papulosus*); pl. xxxvi. figs. 1, 2 (type).)

*Asterias paucispina*, Stimpson; *Pisaster paucispinus* and *papulosus*, Verrill.

The type of Stimpson's *Asterias paucispina* represents the immature phase and that of Verrill's *Pisaster papulosus* a mature stage of this form. The principal distinction lies in the number of dorso-lateral spines. In typical examples these stand singly, or in twos and threes, in one fairly direct to decidedly zigzag longiseries. At the base of the ray a few extra spines are added on either side. These spines or small groups are widely spaced from each other and from the carinals and supero-marginals. Certain variants or intermediates add spines here and there outside the series.

In forma *paucispinus* the spines are usually stout with subconical or acorn-shaped, grooved, differentiated tips. A subforma having very few, rather inconspicuous, dorso-lateral and carinal spines, but with a multitude of large dentate pedicellariæ (often more robust than the spines), is found at Nanaimo, B.C., and represents the extreme of difference from the multispinous subforma of *brevispinus*.

Papulæ are normally very numerous, and on account of the fewer spines are rather more conspicuous than in *brevispinus*. They occur in clusters interspersed with groups of crossed and furcate pedicellariæ, with which in alcoholic specimens it is easy to confuse them. As in other species of *Pisaster* the ventral papulæ are long and increase in number with size of animal. In large specimens they form dense masses between the ventral spines.

Supero-marginal spines 1, or sporadically 2, to a plate; infero-marginal spines 2, occasionally 3; actinal spines in 2, rarely 3, longiseries. Forma *brevispinus* has usually 3 or 4, exceptionally 5, longiseries of actinals at base of ray.

Colour in life similar to *brevispinus*.

Type-locality: Puget Sound, Washington.

Sitka to Santa Barbara, California.

## EXPLANATION OF THE PLATES.

### PLATE XIX.

- Fig. 1. Pisaster ochraceus*, forma *ochraceus*, Monterey. A characteristic furcate pedicellaria. 1 a. An unguiculate straight, or "stone-hammer," pedicellaria.
- Figs. 2, 2 a. Pisaster giganteus*, Monterey. A furcate pedicellaria and external view of one jaw, same scale as fig. 1. 2 b. A "stone-hammer" pedicellaria, scale of 3 b.
- Fig. 3. Pisaster brevispinus*, forma *brevispinus*, Monterey. A furcate pedicellaria. 3 a. External view of jaw for comparison with 2 a, same scale. 3 b. Forma *paucispinus*. Two views of "stone-hammer" pedicellariæ, intermarginal channel.

### PLATE XX.

- Fig. 1. Pisaster ochraceus*, forma *confertus*, Boundary Bay, B.C.
- Fig. 2. Pisaster ochraceus*, forma *confertus-nodiferus*, Departure Bay, B.C.
- Fig. 3. Pisaster ochraceus segnis*, forma *nodiferus*, Laguna Beach, California.
- Fig. 4. Pisaster ochraceus*, forma *ochraceus*, Sitka, Alaska.

### PLATE XXI.

- Fig. 1. Pisaster giganteus*, heavy-spined form, Monterey.
- Fig. 2. Pisaster giganteus*, six-rayed slender-spined form, Monterey.

### PLATE XXII.

- Fig. 1. Pisaster brevispinus*, forma *brevispinus*, multispinous form, Bolinas, California.
- Fig. 2. Same*, Crescent City, California.

### PLATE XXIII.

- Fig. 1. Pisaster brevispinus*, forma *paucispinus*, Monterey Bay, California; subforma with few small spines.
- Fig. 2. Same*, typical specimen from Monterey Bay.
- Fig. 3. Same*, typical specimen from Barclay Sound, B.C.
- Fig. 4. Same*, young specimen, Monterey Bay. This resembles the type-specimen of *Asterias paucispina*, Stm.
- Fig. 5. Forma brevispinus-paucispinus*, San Francisco Bay. This specimen may be considered an example of forma *brevispinus* with fewer than the typical number of spines or of forma *paucispinus* with very numerous abactinal spines. Note adradial series of spines not represented in 2 and 3.

LXVII.—*New Sponges from California*\*.

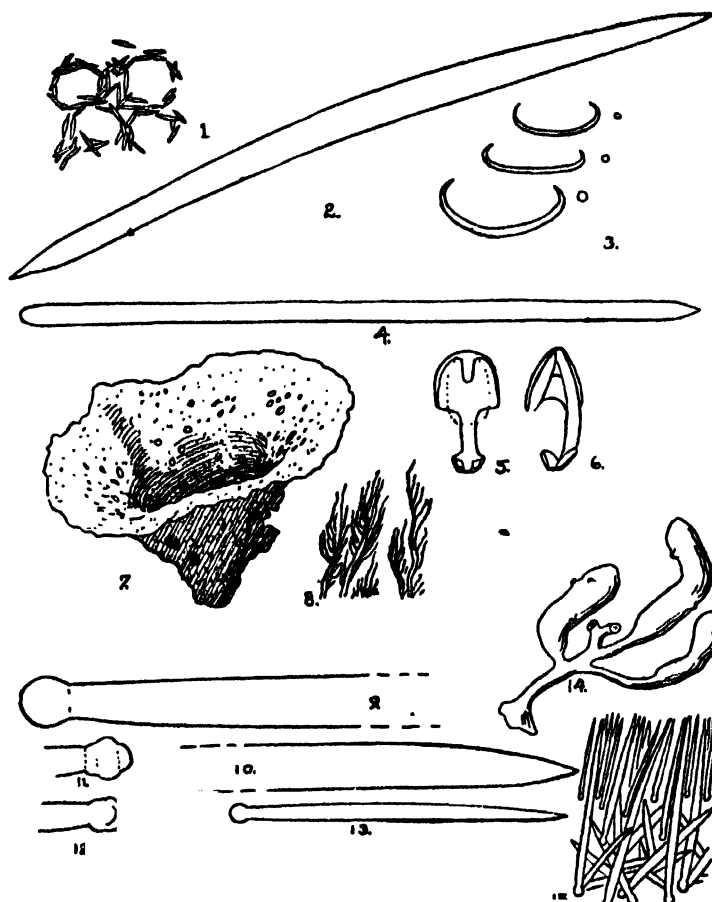
By M. W. DE LAUBENFELS.

THE following descriptions of three new sponges from Monterey Bay, California, are preliminary to a more extended treatise on the Porifera of the region.

*Gellius textapatina*, sp. n.

One specimen was dredged 14 miles west of Santa Cruz, California, at a depth of 400 fathoms; this broke into several fragments, of which one, about 1 by 7 by 12 cm., is more than half. The colour is a pale dirty yellow. In shape it is a cake rather uniformly 10 mm. thick, and slightly concavo-convex. Fragments of shale-like mud still attached indicate that it had been affixed to the bottom by one edge only, either horizontally or vertically. Its appearance would seem to indicate that it had been a horizontal shelf, but this is conjecture only, not certain. The entire sponge is exceedingly delicate and brittle. The oscula are from 0.7 to 1.2 mm. in diameter; there are about 3 or 4 per square cm. and all are on the concave side. The pores are concealed, and the surface rendered smooth by the dermal membrane. On the oscular side it fits quite closely to the ground-substance, and on that side I do not find any openings that I take to be pores, only the minute interspaces of the reticulum. On the convex side are openings of about the same size as the oscula, and a trifle more numerous, differing from them mainly in being covered by the sieve of the dermal membrane. These are evidently the pores; they connect with the oscula by devious canals. The protecting sieve is a spicular membrane of spicules so large, and reticulation so evident, that it is visible to the unaided eye; it has a woven look, much like the appearance of some cane-bottomed chairs. It is noteworthy for a species of this genus, having sigmas as it does, that so few of these are to be found in the dermal membrane. The latter contains practically nothing but the diactinal megascleres. The ground-mass is a reticulum of large, long, sharp oxeas, with practically no spongin evident. Most of the meshes have more than four sides, which sides usually contain but two or three spicules each. The megascleres are on the average 0.02 by 0.45 mm.; the microscleres from 0.002 by 0.05 mm.

\* From the Hopkins Marine Station of Stanford University.



- Fig. 1. - *Gellius textapatina*. Appearance of dermal membrano; enlarged.  
 Fig. 2. - Ditto. Somal oxa; average size.  $\times 250$ .  
 Fig. 3. - Ditto. The sigmas, large, small, and medium.  $\times 250$ .  
 Fig. 4. - *Esperella fisheri*. The megasclere, average size.  $\times 250$ .  
 Fig. 5. - Ditto. Anisochela, front view.  $\times 250$ .  
 Fig. 6. - Ditto. Anisochela, side view.  $\times 250$ .  
 Fig. 7. - Ditto. Sketch of the entire sponge; much reduced.  
 Fig. 8. - Ditto. Appearance of the tufts at the distal ends of the fibres; enlarged.  
 Fig. 9. - *Suberites gadus*. Head end of large tylostyle.  $\times 250$ .  
 Fig. 10. - Ditto. Pointed end of the same.  $\times 250$ .  
 Fig. 11. - Ditto. Another type of head of a tylostyle.  
 Fig. 12. - Ditto. Still another sort of head, found in the spicules of this species.  $\times 250$ .  
 Fig. 13. - Ditto. Small tylostyle, as found in the dermal layer of this species.  $\times 250$ .  
 Fig. 14. - Ditto. Sketch of the entire sponge; much reduced.  
 Fig. 15. - Ditto. Appearance of vertical section of the dermal layer of this species; enlarged.

to 0.004 by 0.08 mm., and are looped and curved to varying degrees. They are rather uncommon, and in many preparations may be entirely wanting. This was true of the first few samples that I defleshed, naturally leading to the assumption that this was genus *Reniera*, which emphasizes the difficulty of correctly allocating a sponge from a small specimen. When microscleres are scarce in a species, small samples are so apt to be devoid of them that I believe they are frequently described, even by the most careful experts, as members not merely of the wrong species, but actually of the wrong genus.

There is still another side to this, and that is to question the generic value of the absence of microscleres. I believe that the genus *Gellius* should be split up among other genera, and that this particular species is really a *Reniera*, even though it has a few sigmas. Furthermore, within the present genus *Gellius* there is a decided gap between the species characterised by sigmas and those characterised by toxas. As Hallman has pointed out ("Report of Sponges obtained by the F.I.S. 'Endeavour' on the Coasts of New South Wales, etc." p. 145) toxas and sigmas do not often occur in the same sponge, and seem to characterize rather different types of sponge; my own observation tends to confirm this. *Gellius textapatina* is set off from many in the genus as now defined by having only sigmas as microscleres, and from *Reniera* only by having microscleres. Its megascleres are exceptionally large, though such species as *Gellius flabelliformis*, *Gellius calyx*, and *Gellius glacialis* resemble it in this respect; furthermore, only *G. glacialis* has sigmas near the size of those in *G. textapatina*. There is some difference even there, the former having sigmas 0.006 by 0.07 mm., where *textapatina*'s are 0.004 by 0.08 mm. (note the difference in thickness). That has oxas 0.036 by 0.650 mm. where *textapatina* has oxas 0.020 by 0.450 mm.; nevertheless, I believe *G. glacialis* to be the closest relative of *G. textapatina*, and consider the most significant difference to be in the dermal layer. This in *G. glacialis* is loaded with sigmas, which are practically absent from the dermal layer of *textapatina*, although present in its ground-mass in small numbers. I do not value abundance of microscleres as highly as some do, but this difference, plus the dimensional differences in spicules, plus the general difference in appearance as judged from the illustrations of *G. glacialis* (Ridley and Dendy, 'Challenger' Report, vol. xx. p. 41, also pl. viii. fig. 7, and pl. xiii. figs. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100),

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15, and 19) constitute abundant grounds for the separation of the Californian form from the Antarctic species.

*Type*.—Will be deposited in the U.S. National Museum; portions will be deposited in the British Museum (Natural History) and in the Zoological Collections of Stanford University.

*Generic Diagnosis of Gellius*.—Grey, 1867, Proc. Zool. Soc. London, p. 538; emend. Ridley and Dendy, 'Challenger' Report, vol. xx. p. 37).

"Very little spongin present, never forming distinct fibres." Add also the definition of the subfamily Gelliniæ (Ridley and Dendy, Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. p. 332): "Megascleres all diactinal, oxea or strongyla, microsclera present, viz. sigmata or toxa. No rind or fistula."

Synonymy: *Asychis*, Gray, loc. cit. 1867, p. 539.

*Desmacodes*, Schmidt, Spong. Atlant. Gebiet. 1870, p. 5.

*Desmacodes*, Vosmaer, Notes Leyden Museum, vol. ii. 1880, p. 104.

*Fibularia*, Carter, Ann. & Mag. Nat. Hist. ser. 5, vol. ix. 1882, p. 282.

### *Esperella fisheri*\*, sp. n.

This is a remarkable sponge, probably one of the largest in any collection. It was brought up from some 60 fathoms deep in Monterey Bay and presented to Dr. Fisher. Its colour, preserved dry, is a dull light brown. Its shape is a large funnel, having a diameter at the brim of *over four feet*! The walls are 30 to 50 mm. thick; slant height on the shortest side 65 cm. inside and 70 cm. outside; on the longest side 95 cm. inside and 1 metre exactly on the outside. The outside is extremely irregular, with coarse-textured, lumpy lobes projecting in some cases 30 to 50 mm. The very bottom part of the funnel on the inside has several pits, each about the size and shape to contain a hen's egg. The gross structure is cavernous with fibres conspicuous to the naked eye. They are basically radiate in plan, with occasional secondary fibres branching off and often anastomosing, outlining cubes. These cubes are walled in as follows: Often on the side towards the inside of the funnel, sometimes on the enclosed sides, and practically never on the outer side, by thin sheets

\* I name this interesting organism after Dr. W. K. Fisher, of the Hopkins Marine Station of Stanford University, with great appreciation of the help and inspiration he has been to me in the very arduous task of working out the taxonomy of this group.

or lamina. In a structure so loose as this it is hard to say what are pores and what are oscula. At the rim the ends of each fibre branch into little fibres, giving a plumose appearance, a characteristic seen in many species of *Esperella*. The skeleton is distinguished first by a moderate amount of spongin, second by large, very straight smooth styles, the sharp end being hastately pointed—size, 0.012 by 0.4 mm. (maximum 0.425, minimum 0.39),—and third by large anisochelæ, 0.075 mm. in length. The fibres are mainly dense masses of the styles in linear series, most, but not all, with their points towards the rim of the funnel. The trabeculæ contain a few megascleres and fairly numerous microscleres.

Though so typical a member of its genus, I find no close relatives for this species. Its shape is distinctive, though *E. simonis* and *E. porosa* are cylindrical, and *E. arenicola* is cake-shaped. Only a few members of the genus have no microscleres other than the anisochelæ, and if they share this peculiarity they usually have chelæ of different shape, or megascleres with the tylote modification.

*Type*.—In Zoological Collections, Stanford University; portions will be deposited in the U.S. National Museum and in the British Museum (Natural History).

*Generic Diagnosis of Esperella*. — Vosmaer, 1885, in Bronn's 'Their-reich,' ii., p. 353: "Shape various, amorphous or symmetrical. Megascleres all monactinal, usually styli; but sometimes with slightly developed, oval heads; smooth. Microsclera, palmate anisochelæ, to which may be added either sigmata, trichodragmata, small isochelæ or toxa, or combinations of these. Fibre usually distinct, branching and anastomosing, often containing much spongin."

Synonymy: *Esperia*, Nardo, Isia, 1833.

*Raphioderma*, Norman, 1869.

*Raphiodoesma*, Bowerbank, 1874.

### *Suberites gadus*, sp. n.

This sponge came up entangled with the fishing-line of a cod-fisher, who estimated the depth to have been 100 fathoms; those familiar with the topography of that section of ocean bottom think this estimate to have been too high. The colour is white, the surface smooth, the consistency dense, moderately firm—what is termed "cartilaginous." As to its shape, basally there are stems just under a centimetre in thickness, branching from one original stem, and giving rise to swollen cylindrical lobes that are always bent,

and often bent at right angles in their middle, and often also with a slight constriction where they are bent. Some of them are shaped much like pea-nuts. These lobes are at a maximum 30 mm. in diameter and a little over 100 mm. long. There are six such lobes in the specimen, and the entire organism in life must have extended upwards over 300 mm. There are a few scattered oscula, averaging 1·7 mm. in diameter, with their round rims raised on small conuli less than 2 mm. high; there is no orderly arrangement of the oscula, none being terminally located on the lobes, and large areas being destitute of them, while in other places several are crowded together closely. The pores are doubtless represented by the minute openings through the cortical layer between the spicules. Canals of irregular shape in cross-section and 0·14 to 0·23 mm. in diameter meander through the main portion of the lobes. The central portion of the stem is so full of large spicules arranged longitudinally that it is very difficult to cut it; it is there brownish in colour, and I think contains more spongin than the lobes do, though neither contains very much. The cortex is approximately 2 mm. thick, and to the eye is set off from the ground-mass of the interior by being milk-white as compared to the creamy-white of the central portion. It consists of a dense grouping of spicules like those of the rest of the sponge, but smaller and packed tightly in phalanges with their points out and coming to a very even line. Most of their heads are also at a fairly even line about 0·2 mm. below the surface, but many have their heads embedded deeper, being longer than the others. This would seem to be an advantageous arrangement from the standpoint of affixing the cortex to the bulk of the sponge. The interior—that is to say, most of each lobe—is a confused grouping of large spicules, with no more definite arrangement than that more are directed towards the surface than those which have their points aimed in any other single direction. In the whole sponge there is but one type of spicule, a rather blunt tylostile, sometimes a little curved, and usually with large, low, rounded bumps on the heads. The sizes vary in the interior from 0·03 by 0·96 mm. to 0·032 by 1·05 mm., and in the cortex from many only 0·01 by 0·2 mm., or a little larger, up to a few almost as large as those of the interior.

Most of the described species of *Suberites* are evidently closely related to each other. That species among the Porifera correspond to species in higher groups—say, birds, for example—is doubtful. The further one gets away from

the higher plants and animals, the less exactly the Linnean system fits, till among the very lowest organisms, where sexual reproduction is relatively uncommon, it becomes very difficult to distinguish between "biotypes" and species. There being no described species to fit this sponge, I must therefore describe it as new. Only a few described species of *Suberites*, such as *S. mollis* and *S. ramulosus*, have spicules as large as *S. gadus*, and of these *S. mollis* is soft and differently shaped and has more pointed spicules. *S. ramulosus* is differently shaped, and its spicules are even larger than in *S. gadus* and are often crooked. *S. subera* has a confused skeleton like *S. gadus*, and also occurs in this locality, but it is orange in colour, differently shaped, and has much smaller spicules. Differences such as these separate *S. gadus* from the other described species, perhaps the most distinctive single feature of the form under discussion being its colour, most *Suberites* ranging from yellow to orange, or even to dark brown, while *S. gadus* is milky-white.

*Type*.—Will be deposited in the U.S. National Museum. Portions will be deposited in the British Museum (Natural History) and in the Zoological Collections of Stanford University.

*Generic Diagnosis of Suberites*.—Nardo, Isis, 1833, p. 523: "Form various, massive to stipitate. Surface devoid of mammiform projections. Skeleton radiately arranged, nearly always with a dermal crust of smaller spicules arranged vertically to the surface. Spicules all monactinal, nearly always tylostylote. No microsclera present."

Synonymy: *Hymeniacion*, Bowerbank, pars.  
*Rhizaxinella*, Keller, pars.

Pacific Grove, California.

LXVIII.—*Aptychus spinosus*, *sp. n.*, from the Upper Chalk.  
By L. R. Cox, M.A., F.G.S.

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[Plate XXIV.]

INTRODUCTION.

A number of specimens of the ammonite operculum described in the present paper have been in the British Museum and other collections for many years, but apparently none had been found when Sharpe's 'Monograph of

the Chalk Cephalopoda' was published (1853-1856). The only mention of it in the literature is in a paper on Upper Chalk Aptychi, by Blackmore (1896, Geol. Mag. [4] iii. p. 531), but here no figures are given, and it is merely referred to as an aptychus much thicker and coarser than those described by Sharpe, "with numerous prominent points which project nearly an eighth of an inch from the external convex surface." It is not included in the "General List of Chalk Fossils" at the end of the Geological Survey memoir on "The Upper Chalk of England" (1904).

My attention was called to the subject by Dr. Fr. Trauth, of the Vienna Natural History Museum, who has recently been studying the Austrian Cretaceous aptychi. Upon seeing photographs of it, he at once impressed upon me the importance of publishing a full description of the present form, which is of a unique and highly interesting type, and is unknown from any locality outside this country. To facilitate the description, Dr. Trauth has been kind enough to send me details of the descriptive terminology which he is employing in his forthcoming monograph, together with a number of references to the literature.

#### GENERAL CONSIDERATIONS.

Except at a few horizons where they occur in abundance, true aptychi—that is, calcareous, shield-like bodies divided symmetrically into two plates—are extremely rare. Although many other theories as to their function have been advanced from time to time, and so recently as 1923 Scalia has published a paper (Mem. R. Accad. Sci. Acireale, [3a] xi.) advocating their Crustacean nature, the occasional specimens which are found actually in place, closing ammonite shells (*e.g.*, the British Museum specimen 39627, of *Oppelia subradiata* from the British Inferior Oolite), seem to prove beyond doubt that they were the opercula of ammonites.

The rarity of aptychi, however, points to the probability that in most ammonites an operculum was either not developed at all or else was horny, like that of most gastropods, and hence only likely to be preserved fossil in exceptional cases. Fossil remains of originally horny structures believed to be the opercula of *Goniatites* are found in rocks of Devonian and Carboniferous age (see H. Woodward, 1885, Geol. Mag. [3] ii. pp. 345-352, pl. ix.); they are shield-like bodies, undivided along their mesial line. In the Mesozoic strata, horny ammonite opercula, likewise undivided mesially, and known as *Anaptychi*, have

been found only in rocks of Liassic age, but this is probably because the character of the rocks of that period has particularly favoured their preservation.

It thus appears that the fundamental type of ammonite operculum was a horny, undivided plate, from which opercula of the aptychus type were developed from time to time, arising independently in quite unrelated stocks. The case is in every way analogous to that of the Gastropoda, in occasional species of which calcareous opercula are developed; and probably, as in that group, the presence, and still less the actual structure, of such a calcareous operculum is very little guide to the systematic position of the species to which it belongs. Thus little significance is to be attached to the division of aptychi into a number of distinct groups according to the nature of their convex surface and internal structure (see Zittel, 1884, Handb. Palæontology, ii. pp. 400-407).

Notwithstanding the absence of any calcareous processes analogous to the teeth of lamellibranch valves, which might assist in holding them together, the two plates of an aptychus are usually found together, in contact along their straight margins. This is the case, not only in the occasional instances when they are preserved in the body-whorl of the parent ammonite, but also very frequently when they are found quite apart from any ammonite. It is therefore highly probable that the plates were always connected together by some cartilaginous structure not preserved fossil, and that the manner of functioning of normal divided aptychi did not differ from that of anaptychi or of the undivided calcareous opercula called by Zittel *Coalescentes*. A divided aptychus must have hinged along its mesial line, and it may have been of advantage to the animal to be able to draw the plates together somewhat when not retracted into its shell.

All aptychi conform to a fairly constant external pattern, since the scope for variation in this respect was limited by the variation in cross-section of ammonite apertures. The accompanying diagram, representing one of the plates of a typical aptychus, will explain a system of terminology which applies to all these bodies, the terms being, in the main, those communicated to me by Dr. Trauth.

Aptychi are all more or less convex, the *convex surface* having faced the exterior when closing the shell, with the *concave surface* attached somehow to the animal. The concave surface is always smooth, except for pronounced growth-ridges concentric at the corner A, which is termed the *apex*, and faint lines radiating from A; sometimes there are one

or more faint ridges running from A to the opposite margin, making very small angles with the straight margin AB, and bounding acutely triangular, flattened or concave areas, distinct from the rest of the concave surface. The convex surface is variously ornamented, its character having been the basis of Zittel's classification. The concave surface of each of the plates is sharply limited by four margins, the inner (AD), the outer (BC), the lateral (CD), and the harmonic margin (AB) (*ἁρμονία*, a joint; since, when two plates are together, it is along this margin that they join).

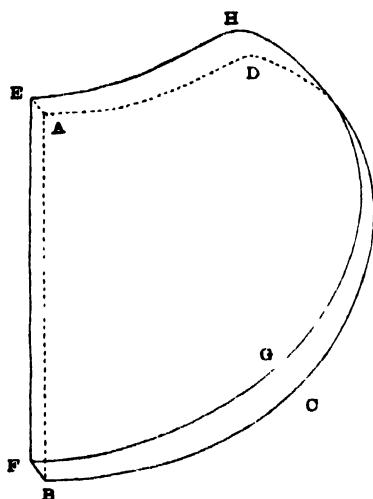


Diagram of a typical aptychus, *A. levis*, Meyer, slightly reduced.

ABCD representing the concave surface and EFGH the convex surface, the latter uppermost; harmonic facet ABFE and inner facet ADIE set at an acute angle with convex surface, and hence obscured from view; outer facet BCGF, and most of lateral facet CDHG, set at an obtuse angle with convex surface, and hence visible.

Whether the lateral and outer margins are differentiated from one another depends, of course, on the contour of the ammonite whorl; in the case where a definite angle CG occurs (the *marginal angle* of Dr. Trauth), the surfaces EGF, EGH may be diverse, meeting along a distinct, obtusely angular ridge EG, which may be flanked on each side by a depression; this ridge is called by Dr. Trauth the *keel*. Aptychi are variable in thickness, some, such as the Upper Chalk forms described by Sharpe, being very thin, while others, such as the well-known Kimmeridge form, *A. latus*, may attain a thickness of well over 1 cm. They are always

thinnest at the apex and thickest near the marginal angle. Where the thickness is at all appreciable, the sides of each plate form definite *facets*, separated from the convex surface, as from the concave surface, by well-marked edges. When closing the shell, the harmonic facets of the two plates were more or less in contact over their whole surface, although occasionally the harmonic margins are seen to be slightly convex, in which case the contact must have been very imperfect. The convex surfaces of the two plates formed a continuous surface across the junction, perpendicular here to the mesial plane of the ammonite, and unbroken by any edge. Owing, however, to the convexity of the whole aptychus, determined largely by the angle which the two surfaces of each plate make with one another at the keel, its effective width was much less than twice the actual width of each plate.

Since it is only by some rare chance that a specimen is found establishing beyond doubt the parent ammonite of an aptychus, little objection can be raised to the practice of giving them definite "specific" names, although this practice originated before their true function was discovered.

*Aptychus spinosus*, sp. n. (Pl. XXIV. figs. 1-3.)

*Diagnosis*.—An *Aptychus* having its convex surface covered with hollow spines or papillæ, irregularly arranged.

*Holotype*.—Brit. Mus. Geol. Dept. 70391 (Pl. XXIV. fig. 2), Upper Chalk, *M. cor-anguinum* Zone [Camden Park, Chislehurst], Kent. Collected by Jeremiah Simmons about 1873.

This and many other specimens, acquired by the British Museum from this collector (including the paratypes referred to below), have been recorded as coming from the Upper Chalk of "Bromley." Mr. G. E. Dibley (1911, *Geol. Mag.* [v.] viii. p. 96) has pointed out that no Chalk is exposed at Bromley proper, and that most probably these fossils, many of which are exceptionally good specimens, came from the now obscured quarries at Camden Park.

*Paratypes*.—Brit. Mus. Geol. Dept. 46576, 46770, 46772, 47719, 48077-8, 62172, 70545, all from the *M. cor-anguinum* Zone [Camden Park, Chislehurst], Kent, and collected by J. Simmons, 1866-1873; C. 3088-91, probably same locality and collector; C. 3092, *M. cor-anguinum* Zone, Charlton, Kent, Bowerbank Coll., purchased in 1865; 48741, Charlton, purchased from B. M. Wright, 1868; 72994, "Kent," purchased from W. Griffiths, 1875; C. 27299, upper part of *M. cor-anguinum* Zone, Kingswood Station Pit, Surrey, collected and presented by Mr. T. H. Withers, 1926.



Also two specimens belonging to, and kindly lent to me by, Mr. G. E. Dibley, from the *M. cor-anguinum* Zone of Grays, Essex, and Northfleet, Kent, respectively.

*Distribution*.—The type-specimens listed above all come from the *M. cor-anguinum* Zone of North Kent, Surrey, and Southern Essex. The specimens referred to by Blackmore were stated to come from the *Marsupites* Zone of the Salisbury district; this zone, however, as understood by Blackmore, included the *M. cor-anguinum* Zone, so that probably these specimens also came from this horizon. Although several important monographs have dealt with the Upper Cretaceous cephalopod faunas of various localities on the European Continent and elsewhere, and many of the aptychi named by Sharpe have been redescribed and figured, no form at all like the present one has been described.

*Description*.—A large aptychus, semi-elliptical in contour, very wide, of considerable convexity, rather thin for its size, with facets scarcely differentiated; angle at apex, between inner and harmonic margins, not greatly exceeding a right angle; lateral and ventral margins joining one another in a regular curve; harmonic margin at times slightly convex; concave surface with well-marked growth-ridges, crossed by faint radial lines; in each plate a pronounced inward reflection of the harmonic margin forming a ridge along this margin, and, inside this ridge, a narrow flattened triangular area separated from the main concave surface by a more or less sharp edge; growth-lines bending towards the apex just before meeting harmonic margin; convex surface without trace of concentric growth-lines, but covered with hollow papilliform spines, usually circular in cross-section, with a circular orifice at their apex; the spines smaller and less numerous on some specimens than on others, and on any one specimen smallest and least numerous near the apex, where they may only be small papillæ; increasing in size and number in later stages of growth, until they may become crowded together, filling the whole of the surface, and attaining a height of 3 mm.; where so crowded, occasionally concrescent in pairs, forming a single spine, elliptical in cross-section, with a double orifice; distribution of spines quite irregular, with no tendency towards a concentric or other definite arrangement.

The microscopic structure of aptychi has been investigated by a number of workers, chief among whom may be mentioned Meneghini and Bornemann (1876, *Atti Soc. Toscana Sci. Nat.* ii. pp. 89–98, pl. iv.). Three layers are usually to be distinguished, the middle one being cellular in structure, and much thicker than the outer ones, which are

comparatively dense. In the present case there has been considerable alteration in the original calcitic structure, so that the section is not as clear as those figured by Meneghini and Bornemann. Three definite layers can, however, be distinguished. The lowest one, forming the concave surface, is dense, retaining no particular structure. The middle layer is very transparent, and is formed entirely of minute crystals of calcite, any original cellular structure having been quite obliterated. The outer layer is not so transparent, but is laminated in structure, the laminæ being parallel to the general surface, from which they sweep up to form the sides of the spines. The spines themselves are seen to be hollow, the cavity extending right down into the aptychus, considerably below the general level of the convex surface, and its inner walls seem to belong to the middle layer of the aptychus, being formed now by minute calcite crystals, without any definite lamination. This hollow character of the spines is of particular interest, since it offers some analogy with the surface-features of other types of aptychus, especially the *Punctati*, which have definite pores opening from the convex surface into the interior.

*Dimensions*.—Unfortunately all the specimens are more or less broken. The largest one (46772) is badly fractured and compressed, but each plate originally exceeded 65 mm. in length and 52 mm. in width. The holotype (70391), a single plate, has its lateral margin broken away, but the last complete growth-stage measures: length 48 mm., width 38 mm., inflation 9 mm.

*Comparison with other Aptychi*.—The only aptychi with which the present form is at all comparable are the *Granulosi* of Zittel. Although this author cites no examples when defining the characters of the group, the typical forms may be taken as those figured by Oppel (1863, "Ueber Jur. Cephalopoden," Pal. Mittheilungen, p. 261, pl. lxxiv. figs. 1-4) as *Aptychus ulmensis*, from Solenhofen. They are thin-shelled aptychi, having their convex surfaces ornamented with concentric rows of small pointed tubercles, which, in the only example in the British Museum (62501), do not seem to have any orifice at their apex. The present form differs from the aptychi of this group in the irregular non-concentric arrangement of its papillæ, in their very much larger size, and in their hollow character; it is, in fact, not possible to place it in any of the groups defined by Zittel.

*Probable parent Ammonite*.—As has been seen, *A. spinosus* is probably confined to the *M. cor-anguinum* Zone, a horizon at which ammonites are extremely rare in this country. The only two species which have hitherto been recorded are

*Parapuzosia leptophylla* (Sharpe) (Kent, Dorset, Berkshire: 1904, Mem. Geol. Surv., "Upper Chalk of England," p. 469) and a doubtful specimen of *Hauericeras pseudo-gardeni* (Schlüter) (Yorkshire: Rowe, 1904, Proc. Geol. Assoc. xviii. p. 295). To these must be added two specimens of *Mortoniceras*, which have recently been found at Cliff, near Gravesend, Kent, and which Dr. L. F. Spath hopes shortly to describe\*.

Although Waagen (1870, 'Palæontographica,' xvii. p. 193) has shown that not every aptychus was the exact fit of the aperture of the ammonite, it can at least be said that an aptychus as wide as the present form must have belonged to an ammonite with a wide aperture. This consideration at once rules out the species *P. leptophylla*, to which Blackmore suggested that the present form belonged, as well as *H. pseudogardeni*. From general considerations it would seem probable that a spiny operculum of the present type might either have resulted from a general tendency of the animal to secrete calcium carbonate, a tendency which would also have been manifested in the production of a spiny or tuberculate shell; or else that it was developed as a means of protection, necessitated by the species being less active and mobile than normal ammonites. Probably in either case it would reflect a phylogerontic condition of the species. Species of *Mortoniceras* usually possess shells with tuberculate ornamentation, as well as wide apertures. Whether, therefore, it was to a species of this genus that *Aptychus spinosus* belonged, or whether to a more obviously phylogerontic species, such as a scaphite or other uncoiled form, not yet found in the *M. cor-anguinum* Zone of this country, must be a subject for future investigation.

#### EXPLANATION OF PLATE XXIV.

(The figures are of natural size.)

- Fig. 1. Aptychus spinosus*, sp. n. Paratype, 48741. Charlton, Kent. The specimen on which the papillæ attain their maximum development.
- Fig. 2. Aptychus spinosus*, sp. n. Holotype, 70391. [Camden Park, Chislehurst], Kent. View of concave surface. The matrix has also been removed from a portion of the convex surface of this specimen, showing well-developed papillæ.
- Fig. 3. Aptychus spinosus*, sp. n. Paratype, 46770. [Camden Park, Chislehurst], Kent.

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\* Since this was written, a paper by Dr. L. F. Spath has been published (1926, Geol. Mag. lxiii. pp. 77-83) containing, in addition to a short description of these two specimens, a discussion of the ammonite fauna of the Upper Chalk of this country.

LXIX.—*Crassicauda bennetti*, sp. n., a new Nematode Parasite from the Bottle-nosed Whale (*Hyperoodon*). By E. A. SPAUL, Ph.D., B.Sc., Birkbeck College (University of London).

SOME specimens of a parasitic Nematode obtained by Mr. A. G. Bennett from the kidney (?) of the bottle-nosed whale (*Hyperoodon* sp.) proved, on examination, to belong to a species of the genus *Crassicauda* hitherto undescribed. Little is known, so far, of this genus, and a complete specimen of either sex has yet to be obtained, so that information at present available is the result of a study of either the anterior or posterior portions of the different species. However, although in this case the material consisted of the terminal portions only, sufficient evidence of a definite nature is provided to allow the establishment of a new species of this genus. The collection contained four posterior portions, three being female and one male.

*Crassicauda bennetti*, sp. n.

The male posterior portion indicated that this animal is smaller than the female in size. The length was 29 cm. The body is cylindrical, with a smooth outer surface, thick walls, and uniform diameter (2.5–3 mm.). At the posterior end the body is flattened dorso-ventrally and expands gradually till it reaches the level of the cloacal opening, when it tapers, to end bluntly, but there is a lack of symmetry, since the left side is longer and curved, the right being practically straight. This expansion begins at 1.6 cm. from the end, and its greatest width is 0.5 cm. Further, a slight twist to the right is noticeable, whilst the ventral surface is concave medially and laterally—the tail curling in and the sides also. A still more remarkable feature is the asymmetrical arrangement of the caudal papillæ. There are not less than nine irregular, but large and mostly flat-headed, projections from the right side anterior to the genital opening, arising from the subcuticular layer of the body-wall. They are all broad (the width of the base being greater than the height) except the most anterior, which is a large finger-like process of the same height. Slight, more or less conical, projections appear on the left side, but they cannot actually be described as papillæ, since they appear to be nothing more than irregularities in the body-wall, for which preservation may in part

Fig. 1.

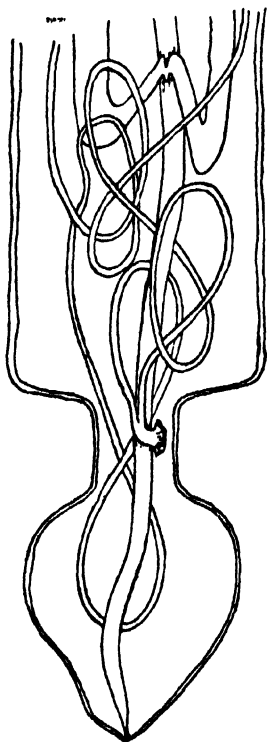
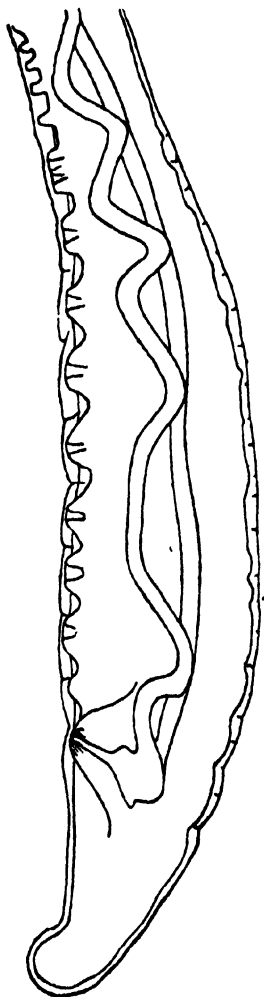


Fig. 2.



*Crassicauda bennetti*, sp. n.

Fig. 1.—Posterior end of female, showing constriction and vulva.

Fig. 2.—Terminal expansion of male, showing asymmetrical arrangement of papillae and the cloacal opening at end of protuberance.

be responsible. The cloacal opening is slightly to the right and 0.4 cm. from the tip of the tail, level with the last papilla, and it opens at the end of a flexible conical protuberance. Shallow depressions extend from this protuberance (*a*) anteriorly between the papillæ and (*b*) posteriorly to the tip of the tail. The intestine is 0.32 mm. in width and uniform, and the vas deferens 0.4–0.44 mm. wide. No spicules were observed.

The lengths of the three female posterior portions were approximately 46 cm., 58 cm., and 100 cm., and seemingly they belonged to mature specimens. The terminal portions were about the same size, possessing the caudal bulbs so characteristic of this genus. The body itself is white, round and smooth-skinned, with thick walls, and uniform in thickness. Towards its end it becomes sharply constricted and then expands into the caudal knob, which is bluntly pointed posteriorly. The intestine runs straight through the body-constriction and bulb to a terminal anus. Its width varies from 0.5 to 0.6 mm. The vulva has swollen protruding lips opening to the exterior on the constriction. The vagina is extremely short, dividing almost immediately into two very long coiled uteri, 0.2–0.4 mm. wide (0.3 mm. for the greater part of their length), which may or may not be filled with eggs. They merge eventually into the ovaries (0.96–1 mm. diameter). The eggs are oval and measure  $60\ \mu \times 30\ \mu$ , but larger eggs were observed ( $70\ \mu \times 35\ \mu$ ) with a conspicuous band of thickened shell in the central region with small terminal caps of thin shell. The relative position of the ovaries and the coiling of the uteri varied considerably in the different specimens, but when the difficulties of dissection from their host and preservation are considered, displacement is to be expected.

Other measurements are compared in the following table:—

no.	Width of body.	Length of constriction.	Width of constriction.	Length of bulb.	Width of bulb.	Distance of vulva from end.
	cm.	cm.	cm.	cm.	cm.	cm.
1..	.6	.3	.4	1.1	.65	1.2
2..	.75	.3	.45	.95	.75	1.3
3..	.8	.25	.35	.8	.7	1.2

From the evidence so far obtained, Baylis (1920) has distinguished two species of the genus *Crassicauda* (Leiper and Atkinson, 1914). An examination of some fragments in poor condition from the same host as the specimens described here led him to suggest the existence of a third species differing in size from the other two. Large ova of characteristic structure and measuring  $66\ \mu \times 33\ \mu$  were found. In the fully formed eggs a thickened band of chitin round the middle region of the shell was noted, the ends being comparatively thin-shelled. Similar features of the shell have been noted in the form described here, and there is no doubt that those fragments belong to the same species. This form is readily distinguished from those already described. The present specimens are the largest yet recorded. Apart from measurements, there is little difference between the females except the shape of the caudal knob and the constriction. It resembles *C. crassicauda* rather than *C. boopis*. A comparison of the males, on the other hand, emphasizes the difference. The absence of spicules agrees with *C. boopis*, but the asymmetry of the terminal expansion is far more pronounced. The number and size of the papillæ, so prominent on the one side and scarcely perceptible on the other, arranged in sublateral rows, with a wide shallow groove between them, and the situation of the cloacal opening at the tip of a protuberance are distinct and characteristic features.

The peculiar asymmetry of the tail of the male members of this genus has been explained by the mode of copulation, when the tail is wrapped round the constriction of the female. Apparently a similar method is adopted in this species, as the following details indicate. The upper edge of the constriction in the female is firm and well-defined, capable of providing attachment and support for the papillæ of the right side of the male, in contrast to the lower edge, which is soft and not at all rigid. Further, the length of the male terminal expansion is approximately equal to the circumference of the female at this point, and its breadth to the width of the constriction. The curvature of this portion shows how it is applied to the female, and sufficient space exists for the protuberance with the cloacal opening at its tip to come into contact with the vulva.

The work was carried out at Birkbeck College, University of London, and my thanks are due to Dr. H. A. Baylis for the opportunity of examining the material.

## REFERENCES.

- BAYLIS, H. A. 1916. "On *Crassicauda crassicauda* (Crepl.) (Nematoda) and its Hosts." *Ann. & Mag. Nat. Hist.* (8) xvii. pp. 144-148.
- . 1920. "Observations on the Genus *Crassicauda*." *Ibid.* (9) v. pp. 410-419.
- . 1922. "Note on the Habitat and Structure of *Crassicauda* (Nematoda)." 'Parasitology,' vol. xiv. 1, pp. 9-12.

LXX.—On a new Species of the Nematode Genus Pharyngodon. By E. A. SPAUL, Ph.D., B.Sc., Birkbeck College (University of London).

SOME parasitic worms collected from *Tarentola delalandii* found in the hills near Las Palmas, Canary Islands, by Mr. S. Hirst, and brought by him to the British Museum, proved on examination to be a new species of *Pharyngodon*.

*Pharyngodon tarentolæ*, sp. n.

The material consisted of adult males and females and several immature females. Their measurements, the averages of which are tabulated, show remarkable consistency in the adults.

In the male the lateral alæ are not distinguishable and there is little difference between the width and dorso-ventral thickness, but the characteristic caudal alæ are prominent as wing-like expansions on either side of the anus. The usual three pairs of anal papillæ are present. The first pair are preanal and form small rounded projections arising just behind the origin of the caudal alæ. The second pair, large finger-like processes stretching out to the edge of the fully expanded caudal alæ, are postanal. The third pair, also postanal, are similar but smaller, and situated at the point where the tail narrows to a tapering filament. They are outside the caudal alæ, which terminate just in front of them. The oesophageal bulb is well defined and the excretory pore is a short distance behind it. No spicules appear to be present. It is impossible to determine whether this is the normal condition or due to imperfect chitinization—a difficulty encountered by other authors describing members of this genus.

The mature female is larger and much broader in proportion to its length than the male. Posteriorly the tail suddenly diminishes to a filament. The vulva always opens



at the same distance behind the excretory pore, which is situated, as in the male, just behind the œsophagus.

Fig. 1.

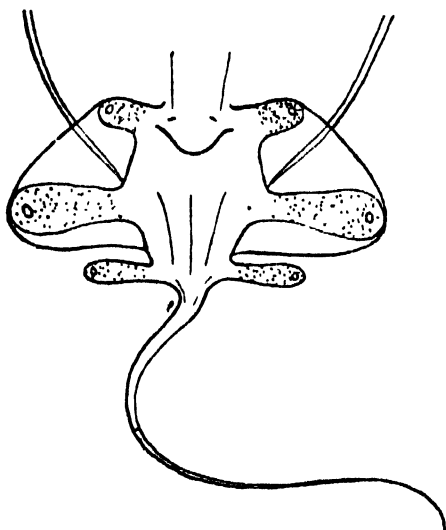
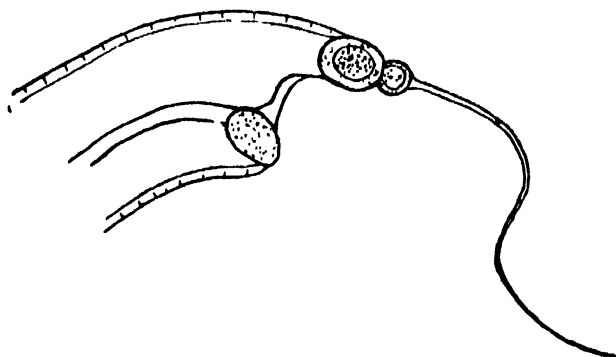


Fig. 2.



*Pharyngodon tarentolæ*, sp. n.

Fig. 1.—Ventral view of posterior end of male.

Fig. 2.—Lateral view of posterior end of male.

The vagina passes back direct from the vulva. The eggs are large and oval, with large nuclei surrounded by granular

cytoplasm. A clear space separates the latter from the well-defined egg-shell, which is thickened at one end. Lateral alæ are not apparent, but the lateral fields extend from the œsophagus to the anus. The cuticle is faintly striated in both sexes.

In the immature female the opening of the vulva is conspicuous and the vagina can be seen, but no eggs are observable. The œsophagus is approximately the same length as that of the adult, but in other respects the animal is proportionately smaller.

The position of the postanal papillæ in the male in relation to the caudal alæ and the absence of lateral alæ are the most prominent distinguishing features of this member of the genus. Several species—*P. extenuatus* (Rud., 1819), *P. laricauda* (Seurat, 1914), *P. auziensis* (Seurat, 1917), and *P. tectipenis* (Geddoelst, 1919)—have the posterior pair of postanal papillæ outside the caudal alæ, as in this case, but they possess more or less prominent lateral alæ. Spines on the tail of the female are not found as in *P. extenuatus* (Rud., 1819), whilst the anterior pair of postanal papillæ are not forked as in *P. auziensis* (Seurat, 1917).

The recorded measurements of all the species mentioned above are not sufficiently complete to allow an exact and detailed comparison, but the varying proportions and different ratios of the length to the tail and œsophagus obtained from those which do exist (see table, pp. 588 & 589), and the dimensions of the eggs, supply still further evidence serving to distinguish this new species.

The genus has been studied by Baylis, who elaborated a key for the identification of its members, but a survey of the literature and figures by the author in connection with the present work revealed a discrepancy between the original descriptions of *P. auziensis* (Seurat, 1917) and *P. megalocerca* (Skrjabin) and their position in the key. Baylis confirmed this after an examination of specimens of the former and the figures of the latter. A revised key is given below, including *P. tectipenis* (Geddoelst, 1919), *P. hindelei* (Thapar, 1925), and the species described here.

#### Key to Species of *Pharyngodon*.

A. Caudal alæ of male include posterior pair of postanal papillæ.

- (a) Adanal pair of papillæ forked . . . . . *P. hindelei*, Thapar, [1925.
- (b) Adanal pair of papillæ not forked. [1897.
- (a) Cuticle of male, between posterior end of lateral alæ and beginning of caudal alæ, inflated on either side . . . . . *P. mamillatus*, v. Linst.,

Table comparing Chief Features of Members of Genus Pharyngodon.

Species.	Length.	Width.	Esophagus length.	Tail length.	Arrangement of anal papillæ in male.	Female tail.	Characteristics of alæ.	Dimensions of egg.	Length of spicules.
<i>P. kindelei</i> (Thapar, 1925). ♂.	mm. 2.4	..	$\frac{1}{8}$	$\frac{1}{16}$	Adanal pair forked, within caudal alæ.	..	Lateral alæ along length of body.	..	42 $\mu$
♀.	4-6	.	$\frac{1}{6}$	$\frac{1}{13}$	.....	No spines.	Two lateral crests uniting to v-shaped structure behind anus	139 $\mu$ × 42 $\mu$	..
<i>P. mamillatus</i> (v. Linst., 1897). ♂.	2.9	.19	$\frac{1}{5.6}$	$\frac{1}{19.5}$	Within caudal alæ.	..	Cuticular inflation between lateral and caudal alæ.	..	21 $\mu$
♀.	3-62	.42	$\frac{1}{6}$	$\frac{1}{7.5}$	.....	.	.....	140 $\mu$ × 40 $\mu$	..
<i>P. spinicauda</i> (Duj., 1845). ♂.	1.8	..	$\frac{1}{6}$	$\frac{1}{14}$	Within caudal alæ.	..	Lateral alæ along length of body.	..	60 $\mu$
♀.	4-75	.23	$\frac{1}{10}$	$\frac{1}{5}$	.....	Spiny.	Two lateral crests along body	155 $\mu$ × 51 $\mu$	..
<i>P. inermicauda</i> (Baylis, 1923). ♂.	1.8	.14	$\frac{1}{6}$	$\frac{1}{12}$	Within caudal alæ.	..	Lateral alæ along length of body.	..	Absent.
♀.	4-7	.38	$\frac{1}{10}$	$\frac{1}{4.5}$	.....	No spines.	.....	170 $\mu$ × 70 $\mu$	..
<i>P. ausiensis</i> (Senar, 1917). ♂.	1.8	.195	$\frac{1}{6}$	$\frac{1}{7}$	Anterior pair of post-anal papillæ forked; posterior pair outside caudal alæ.	..	Lateral alæ along whole length of body.	..	40 $\mu$

♀.	5-25	47	$\frac{1}{11}$	$\frac{1}{7}$	.....	No spines.	Two lateral crests along body.	$147 \mu \times 38 \mu$	..
<i>P. extenuatus</i> (Rad., 1819). ♂.	2-7	23	$\frac{1}{8}$	$\frac{1}{5.5}$	Posterior pair outside caudal alae.	..	Lateral alae along whole length of body.	..	70 $\mu$
♀.	6-6	4	$\frac{1}{13}$	$\frac{1}{5}$	.....	Spiny.	Two lateral crests along body.	$154 \mu \times 31 \mu$	..
<i>P. tectipennis</i> (Ge- doelst, 1919). ♂.	1-6	2	$\frac{1}{4}$	$\frac{1}{6}$	Posterior pair outside caudal alae.	..	Expanded T-shaped lateral alae along body.	..	Absent.
♀.	3	375	$\frac{1}{7.5}$	$\frac{1}{6}$	.....	No spines.	.....	$150 \mu \times 36.5 \mu$	..
<i>P. laevicauda</i> (Seu- rat, 1914). ♂.	1-875	3	..	$\frac{1}{6}$	Posterior pair outside caudal alae.	..	Lateral alae confined to posterior region of body.	..	70 $\mu$
♀.	2-7-5	..	..	$\frac{1}{6}$	.....	No spines.	.....	$160 \mu \times 31 \mu$	..
<i>P. tarentolae</i> , sp. n. ♂.	1-1	403	$\frac{1}{5.5}$	$\frac{1}{10}$	Posterior pair outside caudal alae.	..	Lateral alae reduced.	..	Absent.
♀.	3-6	48	$\frac{1}{8.6}$	$\frac{1}{5}$	.....	No spines.	... ..	$163 \mu \times 50 \mu$	..
<i>P. megalocerca</i> (Skrjabin, 1916). ♂.	1 02-1 5	136-2	$\frac{1}{4}$	$\frac{3}{4}$	Caudal alae reduced.	..	Wide lateral alae along body and long tail.	..	Absent.
♀.	4	34	$\frac{1}{6.5}$	$\frac{1}{4}$	.....	..	.....	$170 \mu \times 55 \mu$	..

- ( $\beta$ ) Cuticle of male not inflated at junction of lateral and caudal alæ. [1845.]
- (1) Tail of female spiny. . . . . *P. spinicauda*, Duj., [1845.]
- (2) Tail of female without spines. . . . . *P. inermicauda*, Baylis, [1923.]
- B. Caudal alæ of male do not include posterior pair of postanal papillæ. [1917.]
- (a) Anterior pair of postanal papillæ forked. *P. auziensis*, Seurat,
- (b) Anterior pair of postanal papillæ not forked. [1819.]
- (a) Tail of female spiny. . . . . *P. extenuatus*, Rud., [1819.]
- ( $\beta$ ) Tail of female without spines. . . . . [1919.]
- (1) Expanded lateral alæ in male begin near anterior end of body. . . . . *P. tectipennis*, Geddeslat, [1914.]
- (2) Lateral alæ of male confined to posterior region of body. . . . . *P. levicauda*, Seurat,
- (3) Lateral alæ reduced or absent. . . . . *P. tarentolæ*, sp. n.
- C. Caudal alæ reduced or absent, well-developed lateral alæ present on body, beginning near anterior end, tail very long. . . . . [bin, 1916.]
- P. megalocerca*, Skrja-

A further species of *Pharyngodon* described by Thapar (1925) is not included in this table, as details of female specimens only are given.

The work was carried out at Birkbeck College, University of London, and I am indebted to Dr. H. A. Baylis for his courtesy in enabling me to examine the material.

Table of Measurements of *P. tarentolæ*, sp. n.

	♂.	♀.	♀ (immature).
	mm.	mm.	mm.
Length . . . . .	1.1	3.6	2
Thickness (dorso-ventral) . . . . .	.06	.48	.24
Anterior end to nerve-ring . . . . .	.0625	.125	.125
" " excretory pore . . . . .	.20	.54	.4
Length of œsophagus (including bulb) . . . . .	.2	.42	.4
Length of œsophageal bulb . . . . .	.054	.105	.1
Width " " . . . . .	.042	.117	.11
Distance between striations . . . . .	.0037	.0125	.0084
Tail (anus to base of filament) . . . . .	.025	.17	.14
" (filament) . . . . .	.09	.48	.375
Diameter of head . . . . .	.016	.083	.08
" œsophagus . . . . .	.008	.04	.075
Position of vulva from anterior end. . . . .	..	.64	.45
Dimensions of eggs . . . . .	..	163 $\mu$ $\times$ 50 $\mu$	..
œsophagus length . . . . .	$\frac{1}{55}$	$\frac{1}{86}$	$\frac{1}{5}$
Tail length . . . . .	$\frac{1}{10}$	$\frac{1}{6}$	$\frac{1}{4}$

# REFERENCES.

- BAYLIS, H. A. 1923. "Report on a Collection of Parasitic Nematodes mainly from Egypt."—Part II. Oxyuridæ. 'Parasitology,' vol. xv. no. 1, p. 17.
- GEDORIST, L. 1910. "Une espèce nouvelle de *Pharyngodon*." Compt. rend. Soc. Biol. Paris, t. lxxxii. p. 860.
- LINSTOW, O. VON. 1897. "Nemathelminthen grösstentheils in Madagascarc gesammelt." Arch. f. Naturg. lxiii. vol. i. pp. 27-34, pls. iv., v.
- SEURAT, L. G. 1917. "Sur les Oxyures des Sauriens du Nord-Africain." Archives de Zoologie Expérimentale et Générale, t. lvi. pp. 401-444.
- SKIJAHIN, K. I. 1916. "Parasitic Trematodes and Nematodes etc." Scientific Results of Zoological Expedition to Brit. E. Africa and Uganda made by Prof. V. Dogiel and I. Sokolov in 1914. Petrograd. Vol. i. no. 4. Russian, pp. 1-98; English translation, pp. 99-157. Pls. i.-x.
- THAPAR. 1925. "Studies on the Oxyurid Parasites of Reptiles." Journ. Helminth. vol. iv. nos. 3 & 4, pp. 83-150.

## LXXI.—*On Mammals from Luluabourg, Southern Congo.*

By A. CABRERA and A. E. RUXTON.

THE present paper is based on three collections of small and middle-sized mammals obtained in Luluabourg, on the Lulua River, Kasai, Southern Belgian Congo, by Father R. Callewaert, of the Catholic mission of Saint Joseph de Luluabourg. The two larger collections, containing in all 678 specimens, were sent to the British Museum of Natural History, where, at the request of Mr. M. A. C. Hinton, we have examined them. A third and smaller series, consisting of 76 specimens, was acquired by the National Museum of Natural Science at Madrid, Spain, and has been studied by only one of us (Cabrera); the authorities of that institution have kindly consented to incorporate the results of his work with the observations made in London. In this way we have been able to form a list of no less than 74 species collected in the same spot by the same collector, giving a very exact idea of the mammalian fauna of the Lulua region. The character of this fauna is in the main intermediate between that of Angola and that of Rhodesia, with several peculiar South Congolese forms, some of which appear to be undescribed. Among the material examined figures the type of the new genus and species of rodent—*Ilylenomys callewaerti*—recently described by Mr. Thomas.

In the following list we give the number of males and

females of every species in each of the two museums concerned, B.M. standing, as usual, for British Museum, while M.M.N.S. means Madrid Museum of Natural Science. A query sign is used when, either by the loss of the original label or by other cause, the sex of a specimen is unknown. Short field-observations in French by the collector, as well as local names, are in some cases given in parentheses.

1. *Nasilio brachyurus*, Bocage.

B.M. 9 ♂, 7 ♀; M.M.N.S. 1 ♂, 5 ♀. (En brousse. Native name "Lutaba.")

2. *Petrodromus tordayi*, Thos.

B.M. 9 ♂, 9 ♀, 1 ?; M.M.N.S. 1 ♂, 3 ♀. (En forêt. Native name "Disenge.")

The white of the underparts in these specimens is more or less washed with ochraceous buff, ranging from almost pure white to pale ochraceous, and thus showing this character to be quite valueless in this species as a basis to distinguish local forms.

3. *Chrysochloris congicus*, Thos.

B.M. 1 ♀, 1 ?. (Brousse sabloneuse. Native name "Ndekesha.")

4. *Crocidura turba turba*, Dollm.

B.M. 3 ♀; M.M.N.S. 1 ♀. (En brousse.)

5. *Crocidura zena*, Dollm.

B.M. 4 ♀, 1 ?; M.M.N.S. 1 ♂, 1 ♀. (En brousse.)

6. *Crocidura occidentalis luluana*, Cabr.

Bolet. R. Soc. Esp. de Hist. Nat. xxv. 1925, p. 20.

B.M. 3 ♀; M.M.N.S. 2 ♀. (En brousse.)

The type of this subspecies is one of the specimens in the Madrid Museum.

7. *Crocidura hirta*, Peters.

B.M. 2 ♂, 9 ♀, 1 ?. (En brousse. Native name "Kapelekese.")

8. *Crocidura bovei*, Dobs.

M.M.N.S. 1 ♀. (Dans les champs.)

9. *Crocidura langi*, Cabr.

Bolet. R. Soc. Esp. de Hist. Nat. xxv. 1925, p. 21.

B.M. 2 ♀; M.M.N.S. 1 ♀. (En brousse.)

The specimen in the Madrid Museum of Natural Science is the type of this species.

10. *Eidolon helvum*, Kerr.

B.M. 1 ♂, 1 ♀. (En forêt.)

11. *Hypsignathus monstrosus*, H. Allen.

B.M. 2 ♀. (Suspendu aux aibies en forêt.)

These specimens mean a noteworthy extension of the range of the hammer-head bat, the southern limit of which is given in Andersen's 'Catalogue' as "the coast regions of French Congo (Ogowe; Fernan Vaz)." Kershaw (Rev. Zool. Afric. xi. 1923, p. 386) mentions, however, a specimen from Luebo, only 80 miles north-west from Luluabourg.

12. *Epomophorus wahlbergi haldemani*, Hallow.

B.M. 10 ♂, 2 ♀. (Sur arbre touffu.)

13. *Epomops franqueti franqueti*, Tomes.

B.M. 2 ♂, 2 ♀. (Dans les arbres.)

14. *Micropteropus pusillus*, Peters.

B.M. 3 ♂. (Courronne des arbres.)

15. *Rhinolophus lobatus*, Peters.

B.M. 1 ♂. (Entre rochers surplombant ruisseau.)

16. *Hipposideros caffer centralis*, Andersen.

B.M. 8 ♂, 9 ♀; M.M.N.S. 1 ♀. (En chambre. Fontes des rochers. Au vol de termites.)

17. *Nycteris grandis*, Peters.

B.M. 1 ♂. (En maison.)

18. *Nycteris hispida*, Schreb.

B.M. 5 ♂, 1 ♀. (En maison.)



19. *Nycteris macrotis*, Dobs.

B.M. 2 ♂. (Dans les branches d'un arbre.)

20. *Nycteris nana*, Andersen.

B.M. 1 ♀. (En chambre.)

21. *Taphozous mauritianus*, Geoffr.

B.M. 1 ♂, 1 ♀. (En forêt.)

22. *Sarcolaimus peli*, Temm.

B.M. 1 ♀. (En forêt.)

23. *Glauconycteris argentata*, Dobs.

B.M. 1 ♂. (A un palmier.)

24. *Scoteinus schleiffeni*, Peters.

B.M. 1 ♂.

25. *Eptesicus rendalli*, Thos.

B.M. 1 ♂, 3 ♀. (Dans la chaume.)

26. *Eptesicus tenuipinnis*, Peters.

B.M. 5 ♂, 3 ♀; M.M.N.S. 1 ♀. (En chaume.)

27. *Pipistrellus nanus*, Peters.

B.M. 8 ♂, 12 ♀. (Dans la chaume.)

28. *Keivoula argentata*, Tomes.

B.M. 3 ♂, 1 ♀. (Fentes de rocher.)

29. *Myopterus whitleyi*, Scharff.

B.M. 2 ♂, 4 ♀. (En maison.)

30. *Mops angolensis niveiventer*, subsp. n.

B.M. 2 ♂, 4 ♀. (En maison.)

*Type.* Adult female, obtained in Saint Joseph de Lulua-bourg, April 16th, 1924. Collector's no. 409.

General colour dark vandyke-brown; under surface entirely pure white, without any buffy or brownish tinge.

Dimensions of type:—

Head and body 72 mm.; tail 34; forearm 45; hind foot 11; ear 21.

Skull: condylo-basal length 19·3; zygomatic breadth 13·4; breadth of brain-case 10·5; upper tooth-row from canine 7·8; lower tooth-row from canine 9·2.

Specimens of *M. angolensis* from different parts of Africa appear to differ constantly among themselves by the coloration of the ventral surface. Those coming from the Angola coast have pale reddish-white bellies; others from the Shire River (Portuguese East Africa) present also the lower parts strongly suffused either with brown or buff, while in specimens from Bagamoyo the belly is white only in the centre. These differences may be of subspecific significance; at least, we think it convenient to describe under a trinomial the form inhabiting the Lulua region, with its quite pure white underside.

In connection with *M. angolensis*, it is interesting to state that this specific name was given by Günther, and not by Peters as generally said. Peters described the typical Angolan bat in the 'Jornal' of the Lisbon Academy, vol. iii. 1870, p. 124, as "*Nyctinomus*, nov. sp.," the name *angolensis* being originally published, and wrongly attributed to Peters, by Günther in the 'Zoological Record' for 1870 (dated October 1871), p. 8, with the quotation of Peters's description as a basis.

31. *Mops thersites*, Thos.

B.M. 1 ♀. (En maison.)

32. *Felis lybica mellandi*, Schwann.

B.M. 1 young ♂. (En forêt.)

It is only on geographic grounds that we use the name *mellandi* for this specimen, as it is a very small kitten without any distinctive character.

33. *Genetta gleimi*, Matsch.

B.M. 3 ♂, 1 ♀. (Dans la brousse.)

The three males are very young, and the specimen with the query still younger, being apparently only a few days old. They have been provisionally named *G. gleimi*, as they correspond most closely to that species.

34. *Nandinia binotata intensa*, subsp. n.

B.M. 3 ♀. (En forêt.)

*Type.* Adult female, obtained in Saint Joseph de Luluabourg, 28th December, 1923. Collector's no. 121.

Colour, both on dorsal and ventral surfaces, much redder and brighter than in typical *binotata*, the dark markings intense black and the light spots much more conspicuous. The coloration is quite different in general hue from that of either the typical form or *N. b. arborea*, and more nearly resembles that of a specimen from Angola in the British Museum, but it is still redder and with the two characteristic light spots more clearly marked. One of the specimens is young and the other very young, but they offer the same colour peculiarities as the adult one. All three specimens are females.

Dimensions of the type:—

Head and body 510 mm.; tail 543; hind foot 84; ear 38.

Skull: condylo-basal length 102·8; zygomatic breadth 56; interorbital breadth 19·6; postorbital constriction 16; nasals 20·5; palatal length 46·5; upper tooth-row from canine 43·7.

35. *Herpestes caffer*, Gmel.

B.M. 1 ♀. (En forêt.)

36. *Thos adustus lateralis*, Sclat.

B.M. 1 ♀. (En forêt.)

37. *Galagoides demidoffi phasma*, subsp. n.

B.M. 17 ♂, 4 ♀. (En forêt.)

*Type.* Adult male from Saint Joseph de Luluabourg, obtained 7th June, 1924. Collector's no. 513.

General colour vandyke-brown, sometimes with a slight cinereous cast, but always darker and browner than in typical *demidoffi* from Senegal; underside pale yellowish buff.

Dimensions of the type:—

Head and body 125 mm.; tail 182; hind foot 43; ear 22.

Skull: total length 35·7; zygomatic breadth 21; breadth of brain-case 19·2; upper tooth-row from canine 12·9.

The dwarf galago of Southern Congo appears to be identical, or very nearly so, with specimens from the Cameroons and Spanish Guinea commonly considered as typical *demidoffi*. The type-locality of the species is, however, Senegal, and specimens from this country are considerably paler and

redder than the Lulua animal, very much like the one without definite locality represented in plate xxv. of the 'Proceedings of the Zoological Society' for 1863. Leaving therefore for the present the Cameroons specimens out of consideration, we think the southern dwarf galago entitled to be subspecifically separated.

38. *Cercopithecus brazzae*, M.-Edw.

B.M. 2 ♂, 4 ♀, 1 ? . (En forêt.)

We follow the late Dr. Allen in using the name *brazzae* instead of *neglectus* for this monkey.

39. *Cercopithecus pygerythrus katangensis*, Lönnb.

B.M. 2 ♀ .

The name of the subspecies is adopted on account of locality, the two specimens being too young for exact identification, one of them a mere baby.

40. *Cercopithecus ascanius kassaicus*, Matsch.

B.M. 8 ♂, 11 ♀, 3 ? . (En forêt. Local name "Ishigombe.")

41. *Colobus angolensis benemakimæ*, Matsch.

B.M. 1 young ♂, 1 ? . (En forêt.)

The white parts of the fur are in these specimens more or less tinged with a roddish-yellow hue, but it rather seems a consequence of some native process of tanning than a natural character. The specific name *angolensis* (Sclater, 1860) must be, of course, preferred to *palliatu*s (Peters, 1868); as for the subspecific name, pending a careful revision of the group, we have adopted that of the geographically nearest described form.

42. *Helioseiurus rufobrachium aubryi*, M.-Edw.

B.M. 3 ♂, 2 ♀ . (En forêt.)

43. *Funisciurus congicus interior*, Thos.

B.M. 1 ♂, 2 ♀ . (En forêt.)

44. *Funisciurus mystax ochrogaster*, subsp. n.

B.M. 5 ♂, 8 ♀, 3 ? . (En forêt. Native name "Mukemu.")

*Type.* Adult female, from Saint Joseph de Luluabourg, obtained 18th March, 1924. Collector's no. 362.

General coloration as in true *mystax*, but the lateral whitish stripe very clearly defined and the ventral surface totally and strongly suffused with ochraceous orange or apricot-buff.

Dimensions of the type :—

Head and body 202 mm.; tail 174; hind foot 44; ear 18.

Skull: greatest length 48·7; condylo-incisive length 43·7; zygomatic breadth 27; upper molar row 9.

The ochraceous underside is the chief distinctive character of this southern form. In typical *mystax* from Spanish Guinea the belly is whitish and the lateral stripe is almost obsolete.

45. *Protorerus stangeri signatus*, Thos.

B.M. 1 ♂. (En forêt.).

46. *Claviglis microtis*, Noack.

B.M. 1 ♂, 4 ♀. (Dans la chaume.)

47. *Claviglis lorraineus*, Dollm.

B.M. 1 ♂, 1 ♀. (Sur arbrisseaux.)

48. *Taterona valida*, Bocage.

B.M. 12 ♂, 12 ♀; M.M.N.S. 3 ♂, 3 ♀. (En brousse. Native name "Mapanga" or "Mpango.")

49. *Rattus rattus*, L.

B.M. 7 ♂, 6 ♀, 2 ?. (En maison, en brousse, creux d'un arbre.)

We dare not use a subspecific name for these specimens without a previous study of the species as represented in different parts of Africa, such as the careful revision of the Indian forms by Hinton. The common house-rat of Luluabourg approaches very much *alexandrinus*, but it is not exactly like true *alexandrinus* from Egypt.

50. *Mastomys fuscus*, Bocage.

B.M. 17 ♂, 14 ♀; M.M.N.S. 3 ♂, 1 ♀. (En brousse.)

Evidently a very common species. The females have ten pairs of teats.

51. *Praomys tullbergi*, Thos.

B.M. 12 ♂, 12 ♀, 2 ?; M.M.N.S. 2 ♂, 1 ♀. (En forêt. Local name "Mulando.")

52. *Praomys stella*, Thos.

B.M. 1 ♀. (En forêt.)

This single specimen lacks the skull, but the skin-characters seem to correspond with those of *stella*. The same species is mentioned by Kershaw from Lundu, on the Upper Mayumbe.

53. *Thamnomys rutilans*, Peters.

B.M. 20 ♂, 14 ♀, 2 ?; M.M.N.S. 1 ♂. (En forêt. Local name "Nsamba.")

54. *Aenomys hypoxanthus hypoxanthus*, Puch.

B.M. 7 ♂, 12 ♀, 2 ?. (En forêt. Native name "Dimunu.").

These rats agree very well with specimens from the Cameroons and Gaboon, and not with *Æ. h. anchietas* from Angola, which is lighter and redder.

55. *Stochomys longicaudatus*, Tullb.

B.M. 4 ♂, 2 ♀; M.M.N.S. 1 ♂. (En forêt.)

56. *Malacomys longipes*, M.-Edw.

B.M. 12 ♂, 10 ♀. (En forêt. Native name "Mumba.")

57. *Colomys goslingi*, Thos. & Wrought.

B.M. 5 ♂, 9 ♀; M.M.N.S. 4 ♂, 2 ♀. (Bord de l'eau; one specimen. En forêt. Dans un ruisseau. Dans l'eau.)

Kershaw has determined a specimen from Luebo as *C. bicolor*; we are convinced, however, that the *Colomys* from Luluabourg is *goslingi*. The colour of the upper parts seems to be subject to slight variation, maybe as a result of environment, as the specimen collected "en forêt" is somewhat brighter and redder than those obtained "au bord de l'eau."

58. *Leggada triton*, Thos.

B.M. 3 ♂. (En marais.)

59. *Leggada bella kasaica*, Cabr.

Bol. R. Soc. Esp. de Hist. Nat. xxiv. 1924, p. 222.

B.M. 8 ♂, 23 ♀, 3 ?; M.M.N.S. 1 ♂, 3 ♀, 3 young ♀.  
(Dans les champs. Local name "Kampingidi.")

The type of this local form is one of the females in the Madrid Museum.

60. *Hylonomys callewaerti*, Thos.

Ann. & Mag. Nat. Hist. ser. 9, vol. xv. p. 667 (1925).

B.M. 1 ♀. (En forêt.)

This specimen is the type of the only described species of the remarkable genus *Hylonomys*.

61. *Cricetomys emini*, Wrought.

B.M. 1 ♂, 3 ♀, 1 ? (En brousse et forêt.)

62. *Lemniscomys pulchellus*, Gray.

B.M. 22 ♂, 10 ♀. (En brousse. Native names "Tshibakele" and "Nshumbantande.")

63. *Lophuromys sikapusi*, Temm.

B.M. 1 ♀; M.M.N.S. 2 ♂, 2 ♀. (En forêt.)

64. *Lophuromys rita*, Dollm.

B.M. 1 ♀, 3 ?; M.M.N.S. 1 ♂, 1 ♀. (En forêt.)

65. *Dendromus pecilei*, M.-Edw.

B.M. 3 ♂, 9 ♀, 1 ?; M.M.N.S. 1 ♂, 1 ♀. (En brousse.)

66. *Dendromus whytei*, Wrought.

B.M. 14 ♂, 16 ♀, 3 ?; M.M.N.S. 3 ♀. (Sur buisson. Local name "Kapskwayi.")

67. *Steatomys pratensis*, Peters.

B.M. 10 ♂, 17 ♀, 1 ?; M.M.N.S. 2 ♂, 4 ♀. (En brousse. Local name "Nsé.")

68. *Dasymys nudipes*, Peters.

B.M. 4 ♂, 2 ♀; M.M.N.S. 3 ♂, 2 ♀. (En forêt.)

69. *Dasymys bentleyæ*, Thos.

M.M.N.S. 1 ♀. (En forêt.)

It is rather interesting to find two so similar species of *Dasymys* living side by side, not only in the same locality but in identical environment. The two forms, however, cannot be confused, *D. bentleyæ* being a somewhat larger animal, with warmer brown back and darker ventral surface, and with a fifth hind foot-pad which is always wanting in *D. nudipes*. Two specimens of *bentleyæ* have been mentioned by Kershaw from Luebo.

70. *Pelomys campanæ*, Huot.

B.M. 16 ♂, 6 ♀; M.M.N.S. 1 ♀. (En brousse. Native name "Ditapa.")

71. *Pelomys minor*, sp. n.

B.M. 18 ♂, 4 ♀, 3?; M.M.N.S. 2 ♂, 3 ♀. (En brousse. Native name "Ngongo.")

*Type.* Adult male, from Saint Joseph de Luluabourg, obtained on 7th April, 1924. Collector's no. 391.

A small *Pelomys* with delicate hind feet and an ill-defined stripe along the middle of back. The general colour of the upper parts is a grizzled mixture of yellow and black, very much as in *P. campanæ* but less olivaceous, the individual hairs being black, with a broad subapical band of bright ochraceous buff. The rump is slightly tinged with cinnamon, and a reddish-cinnamon spot occurs generally before the ear. A narrow and not very clear black stripe runs along the back. Lower parts whitish, strongly washed with pale ochraceous buff. The short hairs covering the feet are of this last colour. Tail blackish above, pale dirty grey below.

Skull rather similar in form to that of *P. campanæ*, but with longer less rounded bullæ and a broader palate.

Dimensions of the type:—

Head and body 131 mm.; tail 113; hind foot 24; ear 13.

Skull: greatest length 30.2; basilar length 23.8; zygomatic breadth 13.6; nasals  $11 \times 3.5$ ; interorbital breadth 4.6; breadth of brain-case 12.6; breadth of palate between the anterior molars 2.5; length of palatal foramina 5; diastema 7.4; upper molar series 5.3.

Very similar to *P. campanæ* in coloration, this new species can be readily distinguished by its dorsal stripe and its smaller size, and specially by the shorter and more delicate



hind foot, in which it is also distinct from the other species of *Pelomys*. The length of its foot is, indeed, 21–26 mm. only, while in *campanæ*, *fallax*, *frater*, and the other previously known species it is 28–32.

There is in the British Museum a specimen of this species from N'gombe, Kasai, collected by Dr. H. Schouteden, which appears to be wrongly mentioned by Kershaw (Rev. Zool. Afr. xi. 1923, p. 368) under the name *Lemniscomys griselda*, this name being also found on its label.

72. *Thryonomys swinderianus angolæ*, Thos.

B.M. 1 ♂, 1 ♀. (Brousse bas-fond.)

73. *Cephalophus nyasæ conigicus*, Lönn.

B.M. 1 ♀. (En brousse.)

As there is no skull for this specimen, it is impossible to identify it with certainty.

74. *Tragelaphus scriptus phaleratus*, H.-Smith.

B.M. 1 ♀. (En brousse.)

LXXII.—*The Spedan Lewis South American Exploration.*—

III. *On Mammals collected by Sr. Budin in the Province of Tucuman.* By OLDFIELD THOMAS, F.R.S.

AFTER collecting the specimens from Southern Bolivia worked out in the 'Annals' for March last, Señor E. Budin, working on Mr. Spedan Lewis's behalf, made a short visit to two localities in the northern part of Tucuman Province, where he obtained nearly three hundred specimens, belonging to twenty-one species. Of these there is again a new *tuco-tuco*, allied to *Ctenomys knighti*, and a new subspecies of the Peruvian cavy (*Cavia tschudii*), whose known range is very greatly extended by its capture in Tucuman.

The other specimens are all of use as rendering more precise our knowledge of the distribution of Argentine mammals, and the good series of *Akodon* and *Marmosa* are particularly likely to be of much value in the future working out of these difficult genera.

We have again to thank Mr. Lewis's generosity for this most useful accession to our National Collection.

The following are the localities at which Sr. Budin worked:—

*Cerro del Campo*, Department of Burruyacu, about 100 km. N.E. of Tucuman city. Some specimens obtained at the foot of the Cerro, about 800 m., and others higher up at about 1200–1500 m.

*Ñorco*, about 20 km. N.W. of Vipos, Department of Tucuman, some 80 km. due west of the previous locality; 1500–2000 m.

A few specimens were also obtained on the Cerro de Tafi-Viejo, between Vipos and Tucuman; 2400 m.

1. *Myotis dinellii*, Thos.

♂. 2246. *Ñorco*, Vipos, 2500 m.

2. *Pseudalopex gracilis*, Burm.

♀. 2051, 2061. Foot of Cerro del Campo, Burruyacu, 800 m.

3. *Oryzomys longicaudatus*, Benn.

9 ♂, 3 ♀. *Ñorco*.

20 ♂, 9 ♀. Cerro del Campo, Burruyacu, 800–1300 m.

2 ♂. Cerro de Tafi-Viejo, 2400 m.

4. *Oryzomys flavescens*, Waterh.

♂. 2266; ♀. 2160. *Ñorco*.

As happens over a great part of Argentina, there are two species of *Oryzomys*—larger and smaller—living side by side, and for these the names of *longicaudatus* and *flavescens* seem respectively applicable, distant as are the type-localities of each from Tucuman. Even the Brazilian species commonly known as *O. eliurus* seems very doubtfully distinguishable from *O. longicaudatus*.

5. *Andinomys edax*, Thos.

♂. 2145, 2153; ♀. 2126, 2157, 2191, 2227, 2245 (yg.), 2264. *Ñorco*, Vipos, Tucuman, 2500 m.

"Lives in round holes, quite clean, and the inside is carpeted with very fine straw; feeds on green herbs."—E. B.

6. *Graomys medius*, Thos.

♂. 2281. Tapia, Tucuman.

Quite like the typical series from Chumbicha, Catamarca.

7. *Phyllotis tucumanus*, Thos.

♂. 2173, 2211, 2241; ♀. 2127. Ñorco, Vupos, 2500 m.

"Caught in traps set at the mouth of Cuis holes, which makes me think they live in good harmony with the Cuisas, as I have caught both kinds in these burrows, although in other places I have seen small holes, quite round and clean, which no doubt belong to them."—*E. B.*

8. *Hesperomys venustus*, Thos.

♂. 2002, 2008, 2009, 2011, 2015, 2022, 2025, 2036, 2042, 2045, 2046, 2065; ♀. 1995, 1996, 2010, 2059, 2060, 2063, 2066. Cerro del Campo, Burruyacu, 800 m.

9. *Hesperomys murillus cordovensis*, Thos.

♂. 2189, 2216, 2228. Ñorco, Vupos, 2500 m.

10. *Akodon varius simulator*, Thos.

18 ♂, 8 ♀. Burruyacu, 800 m.

17 ♂, 12 ♀. Ñorco, Vupos, 2500 m.

11. *Akodon tucumanensis*, All.

9 ♂, 3 ♀. Cerro del Campo, Burruyacu, 800 m.

32 ♂, 20 ♀. Ñorco, Vupos. 2500 m.

In previous papers I find that a number of specimens recorded as *A. cænosus* should have been assigned to *tucumanensis*; but the two species, which live together, are so similar that, without an exhaustive examination of the teeth, it is impossible satisfactorily to name every individual.

Most readily to distinguish skulls of the three *Akodons* in the present collection, dividers may be set at 3.2 mm., a dimension which will approximately fit the first molar + half the second of *A. varius simulator*, the two first molars of *tucumanensis*, and the whole row of *cænosus*.

"Most abundant in the straw-covered fields, and causes great damage among the animals caught, devouring more desirable specimens. Whenever a trap was set I was sure to find one of these little fellows in it."

12. *Akodon cænosus*, Thos.

♂. 1998, 2024. Cerro del Campo, Burruyacu, 800 m.

♂. 2136, 2137, 2139, 2141, 2221, 2225, 2226; ♀. 2113, 2114, 2165, 2215, 2255. Ñorco, Vupos, 2500 m.

"All the Akodons occur in great numbers in the rushlands, where they can be seen running about in broad daylight."—*E. B.*

13. *Bolomys lactens*, Thos.

♂. 2198, 2209; ♀. 2143, 2240. Norco, Vipos, 2500 m. Additional examples of this remarkable proodont species are extremely welcome. It is to be hoped that young individuals will later be obtained, as the structure of unworn teeth is still unknown.

These specimens are all quite like the type in general colour, but their study raises a suspicion that the curious blackish species recently described as *B. negrito* on three examples from Aconquija\* may be merely a dark or semi-melanoid race of *B. lactens*, with which it agrees in essential characters. The three specimens, while widely different from *B. lactens* in general colour, differ among themselves in their degree of blackness and in the amount of ochraceous wash on their under surface, a colour quite similar to that normally found in *lactens*. Further specimens will be needed before the degree of local constancy in this species can be determined.

"Red-bellied Akodon. This beautiful rodent cannot be confused with any other I have sent, and I should be glad to hear if it is new. [Señor Budin captured the original specimen in Jujuy.—*O. T.*] It lives in the straw-covered fields, and I have only been able to capture it in a very small area, and have had no success in other localities."—*E. B.*

14. *Ctenomys viperinus*, sp. n.

♂. 2119, 2125, 2149, 2175, 2186, 2230; ♀. 2128, 2131, 2192, 2239, 2260. Norco, near Vipos, Dept. Trancas, Tucuman, 2500 m.

♂. 2278; ♀. 2269, 2270, 2272, 2274, 2275, 2276, 2277, 2280. Cerro de Tafi-Viejo, Tucuman, 2400 m.

Externally quite like *C. knighti*, of the same warm brown colour above, rather paler and more drabby below. About half the specimens with blackened muzzles and crowns and half without. A majority with white axillary patches and some with inguinal spots. Indeed, all this group of tuco-tucos are very like each other externally, *C. tuconax* alone being of a richer and more chestnut colour.

Skull decidedly smaller than in *tuconax*, averaging slightly

\* *Suprà*, p. 312.

larger than in *knighti*, to which the species would seem most nearly allied. General shape of skull the same, but the zygomata decidedly more expanded, and in consequence the anteorbital foramina are more widely open. Bullæ rather narrow, the paroccipital processes less forwardly expanded on their lower surfaces—thus, in the type of *knighti* the antero-posterior extent of the process is 7.5 mm., while in that of *viperinus* it is less than 5 mm.; in *tuconax*, *budini*, and others it is similarly more expanded than in *viperinus*, in which it rarely attains the level of the basion, while it surpasses that point in the other species concerned.

Incisors slightly broader than in *knighti*, less so than in *tuconax*, their front surface rather darker than in the former. Incisive index of type 105°. Anterior cheek-tooth,  $p^4$ , considerably larger than  $m^1$ , the difference much greater than in *knighti*, where these two teeth are more nearly equal. All the teeth smaller than in *tuconax*.

Dimensions of the type:—

Head and body 213 mm.; tail 76; hind foot 36.

Skull: greatest median length 53; condylo-incisive length 53; zygomatic breadth 34.5; interorbital breadth 12; bi-meatal breadth 32; cheek-teeth, alveoli, 12; crowns 10.7; oblique diameter of  $p^4$  4.6, of  $m^1$  3.9.

*Hab.* as above. Type from Norco, near Vipos, 2500 m.

*Type.* Adult male. B.M. no. 26. 2. 13. 127. Original number 2125. Collected 8th September, 1925.

This is an additional local member of the *knighti* group. The specimens all agree in the skull-characters used, slight as they are, and it seems best for the time being to use a binomial name, even if hereafter intergradation is found to occur with some of the older known forms.

The fine *C. lewisi*, described in the last paper, is also one of this group, but differs from all by its much more proodont incisors.

Sr. Budin's remarkable flair for the capture of tuco-tucos is thus again illustrated in the present collection.

"These Tuco-tucos, whose capture afforded me great satisfaction, live on the tablelands above Norco, where the soil is soft and humid, and the ground is covered with a kind of grass called 'Aibe.' They are not found in the lower zone near Norco, nor on the steep slopes covered with bushes, but they abound on the plateau. They are very timid, and each specimen has taken me at least two nights to capture. In Tucuman the Tuco-tucos are called *Ocultos* (*i. e.*, hidden). At Tafi-Viejo the species proved to be much more easy to trap, as one may return an hour after setting the trap and

find a specimen in it. I had supposed they were a different variety from those collected at Norco."—*E. B.*

15. *Ctenomys latro*, Thos.

♂. 2048, 2054; ♀. 2049, 2052, 2053, 2055, 2062. E. of Cerro Campo, Burruyacu, 800 m.

These specimens agree with those previously in the Museum from Tapia and Vipos in the various little characters which separate *latro* from *tucumanus*.

The two are also separable by colour, *C. tucumanus* averaging decidedly darker than *C. latro*, and being without the light line which in the latter runs downwards from the ear.

16. *Cavia tschudii sodalis*, subsp. n.

♂. 2124, 2130, 2172, 2197, 2208, 2234, 2244, 2257; ♀. 2151, 2163, 2171, 2190, 2224, 2263. Norco, Vipos, 2500 m.

2151 and 2263 are albinistic, of a pale fawn colour.

Essentially similar to *C. t. pallidior*, but even paler, the upper surface just perceptibly paler and more greyish, the belly averaging decidedly paler, practically white instead of buffy.

Dimensions of the type:—

Head and body 218 mm.; hind foot 36.5; ear 35.

Skull: greatest length 55; condylo-incisive length 50.

An older skull is 58.5 mm. in greatest length.

*Hab.* as above.

*Types.* Adult male. B.M. no. 26.2.13.150. Original number 2259. Collected 27th October, 1925.

This is a considerably further extension southwards into Argentina of the known range of the *Cavia tschudii* type of cavy, already much extended by Sr. Budin's S. Bolivian collection, as mentioned in my account of the latter; but, instead of being quite like Simons's Arequipa series, as was the case with the Bolivian set, these all have white bellies, and may fairly be considered subspecifically distinct, as is, indeed, geographically natural.

From the Paraguayan *Cavia aperea azarae*, *C. tschudii* is readily distinguishable by its much smaller size.

"Found on the straw-covered tableland at 2500 m. Called 'Coy' in Tucuman, 'Cuis' in S. Argentina. They make their burrows under small bushes about 1 metre high, or amongst the straw but the holes are always clear round the

entrance and quite visible. The Coys make one or two well-defined little paths leading from the hole out into the straw-covered fields. They prefer to make their home on inclines, but not on steep slopes. Sometimes the homes have several entrances and look like the holes made by Viscachas, which I had not noticed before with the varieties that live in the mountains—that is to say, the Cuises from Tarija, which made their lairs in the broken ground of ravines or under stones [the latter were a species of *Galea*.—O. T.].”—E. B.

17. *Galea musteloides*, Meyen.

♂. 2034, 2039, 2085, 2089; ♀. 2026, 2030, 2033, 2056, 2057, 2101. Cerro del Campo, Burruyacu, 800–1500 m.

♂. 2109. Vipos, 800 m.

♂. 2111; ♀. 2187. Ñorco, Vipos, 1500–2500 m.

“Cuis de Ramas. Caught on very stony broken ground, at 1500 m.”—E. B.

18. *Sylvilagus brasiliensis gilsoni*, Thos.

♂. 2927. Foot of Cerro del Campo, Burruyacu, 800 m.

19. *Didelphis paraguayensis*, Oken.

♂. 1999. Foot of Cerro del Campo, Burruyacu, 800 m.

20. *Marmosa elegans cinderella*, Thos.

♂. 2086, 2095, 2096, 2098; ♀. 2087, 2092, 2105. Cerro del Campo, Burruyacu, 1300 m.

♂. 2120, 2199, 2250; ♀. 2123, 2129, 2164. Ñorco, Vipos, 2500 m.

♂. 2273. Cerro de Tafi-Viejo, 2400 m.

The older specimens of this series have well-marked supra-orbital ridges, and therefore upset the use of this character as a universal distinction between the *Marmosas* of the *elegans* and *marmosa* groups, the discrimination of whose local forms is of such special difficulty.

The series will be of great value in future work on the genus.

“The largest of the group which I have caught up to now. They live in the straw-covered fields, and these specimens I captured by setting the traps in the entrance to the holes of Cuises. In other places where I have collected Achocayas I have generally found them under stones and tree-trunks and in holes made on the hill-sides. Very damaging to

specimens caught, attacking the head of the latter and extracting the brain."—*E. B.*

21. *Marmosa* sp. (near *verax*).

♂. 2110. Estacion, Vupos, Tucuman. 800 m.

This would appear to be a member of the *marmota* group, with pure white belly and very small feet. More material of the group will be needed before the forms contained in it can be defined, but it is not improbable that *verax* extends across the Chaco to the present locality, the specimen being certainly very like the type of that species. Its supraorbital ridges and less pointed skull apparently distinguish it from *M. elegans pallidior*.

"Achocaya. Trapped on a stony hill on the banks of the Rio Vupos."—*E. B.*

LXXIII.—A new *Myotis* from Ladak.

By OLDFIELD THOMAS.

THE British Museum owes to Col. R. Meinertzhagen a specimen of a remarkable bat of the genus *Myotis* obtained by him during a recent visit to Ladak.

While it appears to be a member of the *Myotis mystacinus* group, its colour is so unique as to distinguish it at once not only from all other members of the genus, but almost from any other bat.

It may be called

*Myotis meinertzhageni*, sp. n.

Size and general essential characters as in *Myotis mystacinus*. Fur soft and fine, about 5 mm. long on the back. Base of interfemoral well covered, but its hinder edge without fringe. General colour above a peculiar pale buffy, with a pinkish tone in it, something between "cream-buff" and "light pinkish cinnamon" of Ridgway, the pallor of the colour being equalled by but very few bats. *Myotis myotis risorius*, Cheesm., and *Glauconycteris variegatus*, Tomes, perhaps, resemble it most nearly in this respect. On the head and on the base of the interfemoral the colour is still paler, almost white, the hairs on the latter white to their roots; on the former, as on the rest of the upper surface, the hairs are slaty blackish basally, pale terminally. Under



surface superficially quite white, the bases of the hairs blackish.

Sides of face with a tendency to whiskers, which are blackish, distinct from the general light coloration, being the only hairs on the animal not light superficially. Ears and membranes slaty black, structure of the former as in *M. mystacinus*.

Skull about as in *M. mystacinus*. Teeth very much worn in the type; small premolars in the tooth-row not crowded, the middle one smaller than the anterior and slightly drawn inward.

Dimensions of the type:—

Forearm 37 mm.

Head and body 45 mm.; tail 35; ear 11.

Skull: greatest length 13.5; condylo-sinual length 12; zygomatic breadth 8; interorbital breadth 3.4; breadth of brain-case 6.5; palato-sinual length 6; front of canine to back of  $m^3$  5.2.

*Hab.* Ladak. Type from the junction of the Nubra and Shyok Rivers. Altitude 10,000'.

*Type.* Old female. B.M. no. 26.3.1.1. Collected 17th July, 1925, and presented by Col. R. Meinertzhagen.

This remarkably beautiful little bat is readily distinguishable from any of its allies by its extremely pallid coloration.

When working out the Indian *Myotis* in 1915\* I suggested that Dobson's *M. nepalensis* might be a synonym of *caliginosus*; but in this I was probably in error, as the species would appear to be distinguished by its white under surface, in which latter respect it agrees with *M. meinertzhageni*, while it has the dull upper surface so usual in the group.

LXXIV.—*The Goldman-Thomas Expedition to Peru.*—II.  
*On Mammals collected by Mr. R. W. Hendee in North Peru between Pacasmayo and Chachapoyas.* By OLDFIELD THOMAS.

AFTER completing the collection in the Junin region, of which an account was given in the 'Annals' for March last, Mr. Hendee proceeded to the north of Peru, more or less following the route taken on the historic collecting expedition of Mr. Osgood, who started on the coast at Trujillo and Pacasmayo and worked right across the Cordilleras to the

\* J. Bomb. N. H. Soc. xxiii, p. 610 (1915).

Upper Amazons, afterwards writing a most important paper on the mammals he obtained. So important was that paper, written by one of our greatest authorities on S. American mammals, that it was essential for our knowledge of Peruvian mammalogy that specimens from the same area, corresponding to the species then described, should be available for examination.

Mr. Hendee therefore made special efforts to get specimens of the same forms as those mentioned by Osgood, and he has been so far successful that we are now in possession of many new to us, and I have been able to clear up several points about these animals which still remained obscure.

Such accessions are of particular value, and in supporting Mr. Hendee's journey the Godman Exploration Trustees are doing a real service to science and our National Museum.

This consignment consists of 127 specimens, belonging to 15 species and subspecies, of which one needs description as new, while a renaming of the genus "*Microryzomys*" has also proved to be necessary.

The localities at which the collection was made are as follows:—

*Pacasmayo*, on the sea-coast to the north of Trujillo, and *Celendin*, *Tambo Carrizal*, *Tambo Jenes*, and *Leimabamba*, at altitudes between 8000' and 12,000', in the highlands between Cajamarca and Chachapoyas.

1. *Mus musculus*, L.

9 ♂, 4 ♀. *Pacasmayo*, sea-level.

2. *Oryzomys xanthocolus*, Thos.

♂. 129, 130, 144, 145, 150, 157, 163, 167; ♀. 149, 164. *Pacasmayo*, sea-level.

3. *Oryzomys albigularis*, Tomes.

♂. 254; ♀. 242. *Leimabamba*.

Mr. Osgood has rightly commented on the close affinity and possible identity of a number of forms related to this animal, and described from various localities in Colombia, Ecuador, and Peru.

4. *Oryzomys minutus*, Tomes.

♂. 178. *Celendin*.

♂. 202; ♀. 201. *Tambo Carrizal*.

♂. 206, 215. *Tambo Jenes*, 12,000'.

Arising out of the redetermination of the type-specimen of Tomes's *Hesperomys minutus*, mentioned below, an alteration

in the name of the common species usually called *Oryzomys stolzmanni* is necessitated, for there seems no tangible difference between *stolzmanni* of Peru and *minutus* of Ecuador, although we have but few specimens from the latter country, where the species would appear to be rarer than it is in Peru.

### 5. *Oryzomys arenalis*, Thos.

♂. 138. Pacasmayo, sea-level.

Mr. Osgood suggests that the Callao *Mus peruvianus*, Peale (1848), whose type is lost\*, may have been based on a specimen of this coast-species, which in all probability occurs there.

While I would not deny the possibility of this being the case (although the tail of *arenalis* is longer than that of *peruvianus*, as given by Peale), yet, since the latter was afterwards stated by Peale himself to be synonymous with *Irymomys parvulus*, Tschudi, which is certainly *Mus musculus*†, that identification should stand. *Mus musculus* occurs in numbers in all this region, living wild, like an indigenous mouse, as is indicated by the notes on Mr. Hendee's Pacasmayo specimens of it.

Whether the *Oryzomys* does or does not occur at Callao, therefore, Peale's name should be considered as a synonym of *Mus musculus*, L.

### 6. *Thallomyscus* (nom. nov.) *aurillus*, Thos.

♂. 205, 222, 223. Tambo Jenes, 12,000'.

In reference to this animal, I am sorry to have to confess to a mistake in determination, for which I quite fail to find any excuse. When founding the genus *Microryzomys*‡ I stated that the type-specimen of Tomes's *Hesperomys minutus*, young as it was, showed the characteristics of *Microryzomys* in all respects.

In this statement I was wrong, for a renewed examination of this type (B.M. no. 7. 1. 1. 112), and especially of its teeth§, with the better material we now possess, shows that

\* Cf. Lyon and Osgood, Cat. Type-specimens in U.S. Nat. Mus. p. 289 (1909).

† "Erste Backenzahn in drei Portionen getheilt," Tschudi, 'Fauna Peruana,' p. 178 (1845).

‡ Pr. U.S. Nat. Mus. lviii. p. 229 (1920).

§ The skull is now more or less fragmentary, but the essential parts—the zygomatic plate, the palatine foramina (which penetrate well between the molars), and the tooth-rows—are all available for study. The upper molar series measures 8.1 mm. in length, a dimension never equalled in *Thallomyscus*.

it is not a *Microryzomys*, in the sense then used, but an *Oryzomys*, no doubt of the "*Oligoryzomys*" group—a determination which will, unfortunately, carry several inconveniences in its train; for, since *minutus* was definitely given as the genotype of *Microryzomys*, that name will follow its genotype and become a synonym of *Oryzomys*, while a new name will be needed for the genus containing *dryas* and *aurillus*.

For the latter I would suggest the name *Thallomyscus*, with *Oryzomys dryas*, Thos., as its genotype.

The common small Ecuadorean *Oryzomys* will have to bear the name of *Oryzomys minutus*, Tomes, being a different animal from that so called in Mr. Osgood's Peru paper, the latter being *Thallomyscus*.

In the absence of series representing the true *Thallomyscus dryas* of Ecuador, I am unable to express a definite opinion as to the identity of the Peruvian animals with that species, and for the present use the name most pertinent geographically. But that the two may be found to pass into each other I think by no means improbable, though the type of *dryas* has a larger skull than any we have yet received from Peru.

#### 7. *Thomasomys ischyryus*, Osg.

♂. 234, 241, 243, 252, 255; ♀. 244, 245, 250, 251, 253, 256. Leimabamba.

These specimens agree closely with Mr. Osgood's description of his *Thomasomys cinereus ischyryus*, although, while saying *ischyryus* is larger than *cinereus*, he gives a skull-length which is precisely that of the type of the latter.

On a careful comparison of these specimens with the available examples of true *cinereus* (one, the type, from Cutervo, and two obtained by P. O. Simons on the Paramo above Cajamarca, all localities to the west of the Marañon), I find that there is sufficient difference in Mr. Hendee's series—all from the east of that river—to justify the specific separation of *ischyryus*. This difference rests chiefly in the shape of the skull, of which in *ischyryus* the rostrum is remarkably narrow and pointed, the nasals elongate and pointed behind, the zygomatic plate narrower than in *cinereus*, and less visible from above, while the angle at which the zygomata leave the skull anteriorly is much less outstanding ("flaring"). The interorbital space is broader and more rounded, without even the rudimentary ridges found in true *cinereus*.

These characteristics of *ischyryus* are all equally found in

the next series, from the Tambo Jenes, whence came the specimens identified by Mr. Osgood as true *cinereus*. They should therefore be transferred to *ischyrus*, of which, in agreement with Mr. Osgood as to their degree of distinction, they may be considered a separate subspecies.

"Trapped in dense bush near stream."—*R. W. H.*

8. *Thomasomys ischyrus eleusis*, subsp. n.

♂. 208, 210, 216, 221, 224; ♀ 220. Tambo Jenes, 12,000'.

General colour dark grey, darker than in true *cinereus*, and without the warm buffy or ochraceous suffusion found in true *ischyrus*. Under surface paler grey, the ends of the hairs dull whitish, and with but rarely a faint tinge of buffy. Ears less black than in *ischyrus*. Hands and feet whitish, with less dark on the metapodials.

Skull as in *ischyrus*, with the same narrow nasals and "champagne-bottle" outline of its zygomatic shoulders, in contrast with the more flaring zygomata of *cinereus*.

Dimensions of the type:—

Head and body 126 mm.; tail 141; hind foot 28·5; ear 21.

Skull: greatest length 33; condylo-incisive length 30; zygomatic breadth 16; nasals  $13\cdot6 \times 3\cdot7$ ; interorbital breadth 5·5; breadth of brain-case 14·2; upper molars 5·2.

*Hab.* Tambo Jenes; this being the place in the "Mountains East of Balsas," where Mr. Osgood obtained the series he referred to *T. cinereus*.

*Type.* Adult male. B.M. no. 26.4.1.48. Original number 216. Collected 14th September, 1925.

"Trapped in heavy damp forest."—*R. W. H.*

9. *Thomasomys notatus*, Thos.

♂. 218. Tambo Jenes, 12,000'.

This beautiful species was discovered in the Cuzco area by Mr. Heller, and an additional specimen of it is a valuable accession, which also extends considerably its known range.

10. *Phyllotis andium tamborum*, Osg.

♂. 184, 188, 192, 193, 194; ♀. 182, 183, 189. Celendin.

♂. 197; ♀. 198, 199, 200. Tambo Carrizal, 5000'. (Topotypes.)

♂. 237, 238, 247; ♀. 229, 230, 231, 239, 248. Leimabamba.

In addition to the above we have recently received a series of *Phyllotis* from Chachapoyas, collected by L. Rutter, so that we thus have the original series, including the type, of true *andium*, and topotypes of both *P. andium stenops*, Osgood, and *P. tamborum*, Osgood. With regard to the first of these (*P. a. stenops*) I cannot perceive that our Chachapoyas specimens—topotypes—have their “nasals and rostral part of skull decidedly narrower” than in true *andium*, as they are precisely like the Ecuadorean type in these respects, as apparently in size and other characters. I should therefore be inclined to think that they ought to be considered as true *P. andium*. On the other hand, Mr. Hendee's specimens, above recorded, and also some from different localities in Cajamarca, do average rather smaller than true *andium*, with shorter and more slender feet, although there is no such constancy in the characters as uniformly to separate them from the others. But as a local subspecies *tamborum* might well be recognized.

#### 11. *Akodon mollis*, Thos.

♂. 139, 140, 142, 152; ♀. 141, 143, 148, 153, 154, 156, 158, 165. Pacasmayo, sea-level.

#### 12. *Akodon mollis altorum*, Thos.

♂. 168. Cajamarca, 9200'.

#### 13. *Microtus orophilus*, Osg.

♂. 175, 181, 187; ♀. 176, 177, 180. Celendin.

♂. 225; ♀. 226, 227. Rio Utcubamba. (Topotypes.)

♂. 203, 211, 214, 217; ♀. 204, 207, 209, 212, 213, 219. Tambo Jenes, 12,000'.

These specimens quite agree with Osgood's description of “*Akodon mollis orophilus*,” which was based on specimens from “six miles west of Leimabamba, near the headwaters of the Utcubamba River.” Our specimens from Leimabamba do not agree with the description of *orophilus*, but those above-mentioned from the Rio Utcubamba do, and may be considered as topotypes of it.

While spirit-specimens of *Microtus* and *Akodon* are most obviously distinct by the longer nose and small eyes of the former, it is often extraordinarily difficult to distinguish the skulls and skins, and I cannot guarantee the individual identification of every specimen, especially those from Celendin.

14. *Microxus orophilus orientalis*, Osg.

♂. 232, 235, 236, 240, 249; ♀. 233, 246. Leimabamba, 8000'.

These specimens differ from true *orphilus* so much in the same way as Osgood's *Akodon mollis orientalis* is said to do that they may be safely referred to that animal, even if the local distribution of the two forms *orphilus* and *orientalis* is rather puzzling.

With the exception of the specimens of *Microxus torques* from the neighbourhood of the Inca town of Machu Picchu presented to our Museum by the United States National Museum, the two present sets of *orphilus* and *orientalis* are the first examples of *Microxus* we have received from Peru, and form very valuable material towards a knowledge of these difficult animals. The relations to each other of *Microxus* and *Akodon* are explained in my paper on the Cuzco collection\*.

The difference in colour on which I distinguished *M. torques* from both *orphilus* and *orientalis* is quite borne out by the actual comparison of specimens, although the form may prove to be rather subspecies than species.

15. *Marmosa noctivaga*, Tschudi.

♂. Tambo Carrizal.

I use this name on the basis of my Peru paper of 1920†, but the animal's relationship to Osgood's *M. impavida neglecta*‡ from Yurimaguas will need further study.

LXXV.—On *Cyclops americanus*, Marsh.

By A. G. LOWNDES, Marlborough College.

ON October 29th, 1925, a female specimen of *Cyclops*, carrying ovisacs, was taken from the bottom of Coate Reservoir, near Swindon. The specimen answered to all the available descriptions of *Cyclops americanus*, Marsh.

After the eggs from the ovisacs had hatched out the specimen was sent to Prof. Sars of Norway, who very kindly examined it, and stated that it appeared to be somewhat intermediate between *C. lucidulus* and *C. robustus*, yet differing

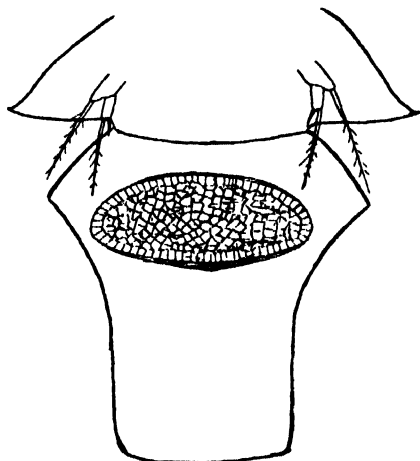
\* Pr. U.S. Nat. Mus. lviii. p. 240.

† Loc. cit. p. 248.

‡ Field Mus. Publ. x. p. 187 (1915).

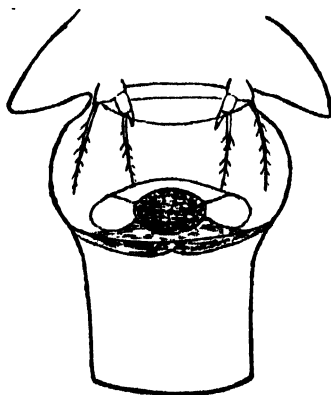
slightly from both. It was, in his opinion, more properly referable to *C. americanus*.

Fig. 1.



*Cyclops lucidulus*. Seminal receptacle,  $\times 175$ .

Fig. 2.



*Cyclops americanus*, Marsh. Seminal receptacle,  $\times 175$ .

Several other specimens have been obtained from the same spot, and a series of breeding experiments have been carried  
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out. From the eggs that were hatched out from the original specimen over a hundred offspring have been examined.

The seminal receptacle of *C. americanus* is apparently quite characteristic, and it differs markedly from that of *C. lucidulus* or *C. robustus*. In all the adult females obtained either directly or by breeding the shape of the seminal receptacle has been characteristic. The species must therefore be considered as separate from either *C. lucidulus* or *C. robustus*, and there is no other species with which it can possibly be connected.

Apart from the seminal receptacle, however, two varieties have appeared, one having the spine-formula 2.3.3.3 and the other 3.4.4.4. Both males and females of both varieties were obtained from the one original female.

Drawings showing the seminal receptacle of *C. lucidulus* and *C. americanus* are given (figs. 1 & 2).

It will be noticed that, whereas that of *C. lucidulus* appears as a broad ellipse occupying the whole width of the genital segment, and equally coloured over the whole surface, that of *C. americanus* consists of a much smaller and almost circular inner area surrounded by a hyaline area.

*C. americanus* has not before been recorded as such on this side of the Atlantic Ocean, and it is another example of the remarkable and apparently correct generalization that the *freshwater Entomostraca are practically cosmopolitan*.

During the experiments a large number of very young females were observed, and it was found that the spine-formula was determinable at a very early stage of development—certainly before the first antennæ had assumed the correct number of segments, and considerably before the seminal receptacle was in any way mature.

From these observations it must be concluded that:—

1. The spine-formula is not of specific value in this species at any rate.
2. Females carrying ovisacs (unless parthenogenesis occurs) are adult in so far as their spine-formulæ are concerned.

These two points seem to be of considerable importance on account of the prominence given to them by the leading authorities in the past. Thus, Prof. Schmeil considers the spine-formulæ of little or no specific value.

On the other hand, Prof. Sars apparently considers them to be of the utmost importance. Profs. Marsh and Herrick, of America, are of the same opinion as Sars.

Again, Herrick maintains that the presence of ovisacs in the female is by no means conclusive evidence that the female is adult.

A full description of *C. americanus* and *C. robustus* are given in 'The Marlborough College Natural History Report,' which is now in the press.

### BIBLIOGRAPHICAL NOTICES.

*Save Australia. A Plea for the Right Use of our Flora and Fauna.*  
By various writers. Edited by Sir JAMES BARRETT, K.B.E.,  
C.B., C.M.G., M.D. Macmillan and Co., Ltd. London, 1925.  
Price 8s. 6d.

THIS little book is a powerful plea for the preservation of Australian fauna and flora, so much of which is unique and represents an era long since past in the rest of the world, and is therefore of great interest to all nature lovers---not only those of Australia.

The book is divided into eighteen sections, each written by an expert on his subject. It gives many valuable suggestions as to the methods of preservation, and will be welcomed by all lovers of nature; while those who have not hitherto found time for such things should read it and learn what a wealth of interest lies in the bush around them. "Our distinctive Flora and Fauna are not safe from extinction; indeed, many interesting and valuable species are perilously near extinction . . . it is not good for human beings to lose touch with Nature . . . young countries are always wasteful of their natural resources, and rarely show sufficient foresight to save areas for parks, gardens, and playgrounds for future developments."

It is true that much is already being done to arouse public opinion in this direction, especially amongst children, but much more is necessary if Australians of the future are to enjoy the rich natural beauties of their country.  
G. M. M.

CARPENTER (G. D. HALE). *A Naturalist in East Africa; being Notes made in Uganda, ex-German and Portuguese East Africa.*  
Oxford (Clarendon Press), 1925. Pp. 187, 9 plates, 23 illustrations, and 3 maps. Price 15s. net.

DURING the Great War, the author was appointed to a hospital in Africa which was never opened, so he applied his leisure to collecting insects, and this volume is the account of his labours. From December 1915 to January 1918 he was moved from one station to another, and, with two exceptionally short and busy bursts of active service, he was permitted to pursue his collecting habits. Later, he obtained two months' leave, came to Durban, and, passing on to the

Victoria Falls, spent ten days there in quiet contemplation of that marvellous spectacle. After this he was released, and allowed to resume his interrupted work on the tse-tse fly, *Glossina morsitans*, and arrived at Entebbe a week after the Armistice.

It is hardly possible to give a concise account of the volume, as it consists of diary-like notes of the various insects studied or taken; but an exception must be made of the pages relating to the Victoria Falls, which are fully described and illustrated by ten half-tone blocks from photographs and a sketch map. After this follows a narrative of a long series of experiments on the edibility of various insects when offered to monkeys. Mimicry in Lepidoptera, beetles, and flies conclude the volume.

As previously stated, the volume appeals especially to the entomologist, as it abounds with observations in the field corroborating previous reports.

B. D. J.

## PROCEEDINGS OF LEARNED SOCIETIES.

### GEOLOGICAL SOCIETY.

June 10th, 1925.—Dr. J. W. Evans, C.B.E., F.R.S.,  
President, in the Chair.

Prof. HERBERT LEADER HAWKINS, D.Sc., F.G.S., exhibited a series of Echinoidea from the Portland Stone and the Purbeck Beds, and explained that the specimens had a peculiar interest by reason of their rarity and good preservation. Before last year only one species (*'Echinobrissus' brodiei* Wright) was known from the Portland stone, and this form was represented by very few examples, mainly collected in Buckinghamshire. A species of *Hemicidaris* from the sands was the only other Echinoid recognized in the British Portlandian. The work of Lt.-Colonel Cunningham has revealed three excellent specimens of *'E.' brodiei* in the basement-bed of the Portland Stone (and one from the overlying Whit-Bed); and, in addition, adequate material for the study of four other species, with indication of a sixth. The collection from the basement-bed comprises 21 specimens, which may be classed provisionally as follows:—

<i>Tetragramma</i> sp. nov. A.	2 specimens.
<i>Tetragramma</i> sp. nov. B.	10 do.
<i>Trochotiarra thirriai</i> (Étallon) var. nov.	3 do.
<i>Trochotiarra</i> sp. nov.	1 do.
(?) <i>Trochotiarra</i> sp. indet. (radiole).	1 do.
<i>Hemicidaris</i> sp. indet. (radiole).	1 do.
<i>Clitopygus brodiei</i> (Wright).	3 do.

*Trochotiarra thirriai* is a well-known form from the Portlandian of Northern France. The occurrence of two well-marked species

of *Tetragramma* is interesting. This genus is essentially of Cretaceous date, only two species having been recorded from Jurassic strata. Species B shows some resemblance to one of these, the imperfectly known *T. rougonense* (Cotteau); but species A has an almost Cenomanian aspect. All of the forms will be described and figured at an early date.

At the same time Prof. Hawkins introduced to the Fellows the results of a search made by himself in the Middle Purbeck Series of Durlston Bay, near Swanage, in the summer of 1924. *Hemicidaris purbeckensis* Forbes (which was collected from that locality about 75 years ago) has not been recorded from England since its first discovery, although it is well known in France. He collected 38 tests (mostly crushed, but otherwise complete) and innumerable detached plates and radioles, in the course of a few days, no fewer than 14 tests being extracted in a single hour. In addition, two specimens of an apparently new form referable to '*Pseudodiadema*' *sensu latissimo* rewarded his efforts. Thus, in the course of a few months, after a delay of three-quarters of a century, the Echinoid fauna of the Portland Stone has been increased sixfold and that of the British Purbeck Series has been doubled; while the number of specimens now known from both horizons has been enormously multiplied.

The speaker commented on the extremely irregular distribution of Echinoids in these and other Jurassic strata—a distribution which leads to such strange anomalies in collecting as those indicated by the exhibit now shown. He suggested that the irregularity might be ascribed to the known tendency of Echinoids to live in restricted clusters (comprising several species of similar ecological quality), which seem to migrate wholesale in successive generations. This explanation seemed more probable than any alternative based on *post-mortem* segregation of empty tests by the action of currents, since in general the specimens were exquisitely preserved, and often retained their radioles and masticatory apparatus.

June 24th, 1925.—Dr. J. W. Evans, C.B.E., F.R.S.,  
President, in the Chair.

The following communications were read:—

1. 'On a Sagittal Section of the Skull of *Australopithecus africanus*.' By Prof. William Johnson Sollas, M.A., Sc.D., F.R.S., F.G.S.

The Author, after comparing sagittal sections of the skulls of the Anthropoid Apes, the Hominidæ, and the Taungs skull, concludes that the last-named presents numerous and important characters, by which it differs from the Anthropoids and makes some approach towards the Hominidæ.

He considers that his observations fully justify the claims of *Australopithecus* to generic distinction.

2. 'The Faunal Succession in the Carboniferous Limestone and Bowland Shales at Clitheroe and Pendle Hill.' By Donald Parkinson, B.Sc., F.G.S.

The rocks described form that portion of the south-eastern limb of the Clitheroe Anticline which is included between the Twiston and Clitheroe Faults, along with most of the scarp-face of Pendle Hill.

The succession is as follows:—

Strata.	Zones and Sub-zones.	Approximate thickness in feet.
PENDLE GRIT.		
BOWLAND SHALES.	<i>Homoceras leion</i> (?)	50
	<i>Eumorphoceras pseudobilingue</i>	400
	<i>Goniatites spirale</i> P <sub>2</sub>	250
	<i>Goniatites sphaericostriatus</i> P <sub>1</sub>	600
PENDLESIDE LIMESTONE SERIES.	<i>Emmonsia parasitica</i> D <sub>2</sub>	40
	<i>Idiostroton arachnoideum</i> D <sub>2</sub>	260
	<i>Beyrichoceras hoddereuse</i> D <sub>1</sub>	300
WORSTON SHALE SERIES.	<i>Prolecanites compressus</i> D <sub>1</sub>	1100 1800
CLITHEROE LIMESTONE.	{ Salt Hill Knoll Series. <i>Pustula onalis</i> S.	900-1400
	{ Coplow Knoll Series. <i>Spirifer subcinctus</i> C.	400
	{ Chatburn Limestone. <i>Pustula nodosa</i> Z-C <sub>1</sub>	700+ Base not seen.

The lowest beds appear to be of Z age, but the junction of Z and C is an uncertain horizon. The Coplow Knoll Series is of similar facies to the C zone of County Clare, and the Waulsortian of Belgium. The knoll-limestones pass laterally into shales and crinoidal limestones. The Salt Hill Series, of S age, shows similar lateral variations. The knolls of this group are finely developed, and one (Worsaw) is about 1400 feet thick.

The Worston Shale Series, of probable D<sub>1</sub> age, includes most of the 'Shales-with-Limestones' of the Geological Survey maps. It is overlain by the *hoddereuse* goniatite-band, which forms a constant feature along the foot of Pendle Hill.

The Pendleside Limestone proper contains an Upper D coral-brachiopod fauna, with *Goniatites crenistria* at the top. The Lower Bowland Shales with *G. sphaericostriatus* and *Posidonomya becheri* succeed, and these beds are correlated with P<sub>1</sub> of Loughshinny and with the Lower Yoredale Series. It appears probable that the beds usually referred to Lower P are in reality of D<sub>2</sub> age.

The *Spirale* Zone is correlated with P<sub>2</sub> of Loughshinny. The *Pseudobilingue* Zone terminates below the Pendle Grit, where another goniatite (possibly *H. leion*) appears, and forms a continuous horizon just below the grit. It is suggested that the base of the Upper Carboniferous should be drawn here.

The nature of the junction of the Worston Shales with the knoll-limestone is discussed. The shales appear to have been deposited on a very uneven sea-floor, the irregularities being due to the mode of accumulation of the limestones, and not to interformational uplift and erosion. This, and other evidence, lends support to Tiddeman's theory of the origin of reef-knolls.

The paper contains faunal lists, and palæontological notes on some of the corals and brachiopods.

3. '*Cyathoclisia*: a New Genus of Carboniferous Corals.' By Miss Janet Mitchell Marr Dingwall, M.A., B.Sc., F.G.S.

This paper describes certain Tournaisian corals of limited range, which are fairly abundant in certain localities in the South-West of England and South Wales. These forms agree with *Clisiophyllum* in their general features, but differ so markedly from the Viséan species of the genus in structural details that it has been deemed desirable to assign to them a new generic name. The name *Cyathoclisia*, suggested by Dr. W. D. Lang, is here adopted. The new genus includes forms previously described by Arthur Vaughan as *Cyathophyllum*.

The members of this genus are simple rugose corals, with a characteristically smooth epitheca. The calyx is deep, and from the floor rises a sharp spine-like central column. There is a well-developed central area, an intermediate zone of tabellæ, and an outer zone of dissepiments. The major septa are numerous, and are almost invariably continuous from the epitheca to the centre. A short, but often strongly thickened, medial plate is usually present. There is a well-developed fossula, occupied by a long cardinal septum. The tabellæ of the central area are much more numerous, and more steeply inclined, than in the intermediate area.

One species—*Cyathoclisia tabernaculum*—is described in detail, along with its developmental stages. The remarkable variability of the species is discussed, and variations are described; but it has not been found necessary to create more than one species.

*Cyathoclisia tabernaculum* appears to have a limited distribution, both horizontally and vertically. So far as is known, it is confined to the South-Western Province of the Carboniferous Limestone. It appears suddenly in the  $\gamma$  beds and then as quickly disappears, although a few isolated individuals linger in C.

*Cyathoclisia* is contrasted with *Clisiophyllum* and *Palæosmia* (*Cyathophyllum*), and its affinities are discussed. It is probable that in *Cyathoclisia* and *Clisiophyllum* we have an example of parallel developments, and the time of its appearance and the similarity of structure suggest that *Cyathoclisia* may have been developed from *Palæosmia*.

November 18th, 1925.—Dr. J. W. Evans, C.B.E., F.R.S.,  
President, in the Chair.

The following communication was read:—

'A Revision of the Orbitoides of Christmas Island (Indian Ocean).' By Winfred Laurence Falkiner Nuttall, D.F.C., M.A.; F.G.S.

The British Museum Monograph of 1900 included a paper by Prof. T. Rupert Jones & Mr. F. Chapman on the Tertiary foraminiferal limestones. These authors described the smaller foraminifera

as well as the larger Orbitoides, the latter group being little known at the time when their work was undertaken.

The Author re-examined the Orbitoides, primarily in order to ascertain whether with their aid new light could be thrown on the age of the beds. In so doing he found that the original descriptions of the species were often inadequate, and details were omitted which of recent years have become of prime importance in their recognition. He has, therefore, been led to make a complete revision of Jones's and Chapman's species. He has identified six species of *Lepidocyclina*, one species of *Miogypsina*, and one of *Spiroclypeus*. The Lepidocyclines are characterized by possessing no pillars in the lateral chamber-layer, and the two megalospheric forms have the embracing type of primordial chamber restricted to the subgenus *Eulepidina*. These species are found in Limestone C, as defined in the Christmas Island Monograph, which formation is classified as Lower Miocene. The Author has found a *Discocyclina* in Limestone B as well as in A, no Orbitoides having been hitherto discovered in the former. This indicates that these beds are both of Eocene age.

January 6th, 1926.—Dr. J. W. Evans, C.B.E., F.R.S.,  
President, in the Chair.

The following communication was read :—

‘Fossil Plants from the Nubian Sandstone of Eastern  
Darfur.’ By Wilfred Norman Edwards, B.A., F.G.S.

The plant-remains described in this paper were found in 1924 by Mr. G. V. Colchester, Assistant Geologist to the Sudan Government, at Jebel Dirra, 75 kilometres east of El Fasher, in Darfur. They occur in highly silicified quartzitic sandstone, belonging to the Nubian Sandstone, and are the first fossils to be found in that formation in Darfur. The species identified, which probably grew in dune conditions, are *Weichselia reticulata* (Stokes & Webb), *Frenelopsis hoheneggeri* (Ettingshausen), *Dadoxylon ægyptiacum* Unger, and indeterminable fern-fragments. They afford strong evidence for assigning the beds in which they occur to the Lower Cretaceous, or possibly to the base of the Upper Cretaceous.

## MISCELLANEOUS.

### *On some Neotropical Lizards: a Correction.*

IN Mr. H. W. Parker's paper in the March number, pp. 291-301, the following correction should be made :—

Under *Lepidoblepharis microlepis* (Noble), on p. 295, line 5,  
the date 1893 should read 1923.

THE ANNALS  
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LXXVI.—*On various Mammals obtained during Capt. Wilkins's Expedition in Australia.* By OLDFIELD THOMAS.

DURING Capt. G. H. Wilkins's collecting-tour in Australia, besides the two striking species of rock-wallaby described in the January issue of the 'Annals' (*suprà*, p. 184), a number of specimens belonging to other groups were obtained, and I have now had an opportunity of working through them.

ON ROCK-WALLABIES OF THE *PETROGALE PENICILLATA-ASSIMILIS* GROUP.

Of animals that have been referred to these two species the British Museum now contains a considerable number, mostly from different parts of Queensland. Thus there are, firstly, the specimens from the Gould collection which were obtained on the Liverpool Range, in the Upper Hunter River district of New South Wales, and these may be considered as typical *penicillata*, determined by Gray and figured by Gould as such. Captain Wilkins collected one of this species at Dorrigo, Eastern New South Wales.

Then to the north we have fine series from Townsville, Magnetic Island, Inkerman, and Bloombury, 19° to 21° S. lat., which clearly represent Ramsay's *P. assimilis*, described from Palm Island, 18° 45' S.



But between these two there are series from Westwood, near Rockhampton, and Eidsvold, inland of Bundaberg, which appear to represent a third species, more or less intermediate between *penicillata* on the south and *assimilis* on the north.

Although it is possible that all three forms may be found to pass into each other, it seems most convenient for the present to use binomial terms for them, and the intermediate one may therefore be called

*Petrogale herberti*, sp. n.

Size as in *assimilis*, rather smaller than in *penicillata*. General coloration of rather less saturate type than in *penicillata*, but not so grey as in *assimilis*. Head and fore back dark grey, rarely as light as in *assimilis*; hinder back more or less suffused with tawny, less strong and less extended than in *penicillata*. A large blackish axillary patch, succeeded behind by a well-marked white vertical band, much more distinct and strongly defined than in either of the allied species, though less so than in *venustula*; the black patch continued forward on the underside of the forearm proximally. Crown with a median black line, generally sharply defined. Ears with their distal halves anteriorly black or blackish, averaging much darker than in *assimilis*; their inner surfaces buffy whitish, not so yellow as in *penicillata*. Forearms brown, those of *assimilis* buffy whitish; hands black. Hind legs and metatarsals brown, digits black. Tail for its proximal half brown, about like the fore back, its terminal half black, commonly bleaching to brown, a patch at its base dull tawny. It is thus darker than in *assimilis*, with more black terminally, but much lighter than in *penicillata*, in which it is nearly wholly black; in its degree of hairiness it is intermediate between the two.

Skull about as in *assimilis*, rather smaller than in *penicillata*.

Dimensions of the type:—

Head and body 490 mm.; tail 520; hind foot 142; ear 65.

Skull: greatest length 104; condylo-basal length 96; zygomatic breadth 54; nasals  $4\frac{1}{2} \times 12$ ; interorbital breadth 17; diastema 19; secator 6.8.

*Hub.* Highlands of South-east Queensland from about 23° to 26° S. lat. Type from Eidsvold; other specimens from Westwood, near Rockhampton.

*Type.* Old female. B.M. no. 22.12.29.9. Original number 5. Collected 2nd January, 1922, by T. V. Sherrin. Presented by the Trustees of the Godman Exploration Fund. Seventeen specimens examined.

Distinguished on the one hand from *assimilis* by its darker, less grey colour, better defined white side-streak, brown forearms, and greater extent of blackish on the tail, and on the other from *penicillata* by its less saturate general colour, whiter side-streak, paler under surface, and the reduction of the black penicillation of the tail.

Named in honour of Dr. G. F. Herbert Smith, Assistant Secretary of the Museum, to whose initiative and active assistance so much of the success of Capt. Wilkins's expedition is due.

*Petrogale puella*, sp. n.

Allied to *P. assimilis*, but decidedly smaller.

General coloration very much as in true *assimilis*, as represented by specimens from Inkerman, Townsville, and Magnetic Island, paler and greyer than the animals from Westwood and Eidsvold described above. No nuchal dark streak. Fore back greyish, hind back dull greyish buffy, practically quite as in *assimilis*, but with even less tawny on the rump—in fact, the tawny is confined to the base of the tail itself. Head grey, without special markings, though the crown may be blackish. Proectote of ears blackish. A blackish axillary patch, passing into tawny on the sides of the chest and inner side of the forearms; no light streak behind it. Hairs of under surface dark smoky grey, washed terminally with dull whitish and tawny. Forearms to metacarpus and hind legs to metatarsus pale buffy; digits becoming black terminally. Tail rather more thickly haired than in *assimilis*, black or coppery for all but the basal four or five inches, the dark more extended upwards than in either *assimilis* or *purpureicollis*.

Skull essentially as in *assimilis*, but considerably smaller. Interorbital region less concave; supraorbital edges more parallel, less convergent backwards. Muzzle and nasals of similar shape. Teeth as in *assimilis*, the secator of about the same size.

Dimensions of the type:—

Head and body 450 mm.; tail 500; hind foot 140; ear 62.

Skull: greatest length 93; condylo-basal length 86; zygomatic breadth 49.5; nasals 38 × 12; interorbital breadth 15.5; diastema 18.5; length of secator 7.

*Hab.* Central North Queensland, on the extreme Upper Flinders River, and the Torrens Creek, which runs southwards to the Thomson and Barcoo Rivers, on the Great Divide, near 144° E., 21° S. Type from the Glendower Station, Flinders River. Altitude 1700'.

*Type.* Adult female (secator up and worn,  $m^4$  not up). B.M. no. 25. 8. 1. 50. Original number 218. Collected 10th November, 1923, by J. E. Young on the Wilkins Expedition. Six specimens, adult and young.

Readily distinguishable from *P. assimilis* by smaller size and parallel-sided interorbital region. Le Souef's *P. purpureicollis*, found to the west of this locality, is of the same size as *P. assimilis*, with a basal length of 94.5 mm., as compared with 81.5 in the present animal.

In a young specimen about a foot in length there is a more complete median dorsal streak than in the adult, well-marked on the nape and fore back, and only dying away on the rump.

*Petrogale venustula*, sp. n.

A very small species with particularly brightly contrasted shoulder-markings.

Size very small, slightly smaller even than in *P. longmani*, which is probably the nearest ally. General colour of back, in unbleached pelage, warm brown, like "cinnamon-brown," darkened by the black ends to the hairs. In bleached pelage the back is rufous sandy. Under surface grey, with pale buffy tips to the hairs. Face dull fawn. Dark nuchal band beginning on the crown and running down to the withers, but not strongly marked. Ears with their proectote cinnamon at base and dull brown distally, their inner side and margins white. Lateral markings strongly developed, a large black patch behind the elbow, succeeded by a broad and sharply contrasted white band, which fades above into grey on the sides of the nape. Hips with the usual anterior and posterior bands greyish. Forearms bright cinnamon, hands blackish. Hind legs cinnamon, becoming more sandy on ankles and feet; ends of toes black when unbleached, sandy brown in faded pelage. Tail with its upper surface mixed black and buffy, more sandy below, its end inconspicuously tufted with black.

Skull rather smaller than that of *P. longmani*. Muzzle long and slender. Nasals narrow in front, much broadened behind, their posterior edge transverse, not a little projected backwards in the middle, as in that animal. Supraorbital edges sharp, parallel. Palatine foramina short.

Dimensions of the type:—

Head and body 380 mm.; tail 345; hind foot 102; ear 41.

Skull: greatest length 83; condylo-basal length 80; zygomatic breadth 45; nasals  $33 \times 14$ ; interorbital breadth

14 ; palatal foramina 3·5 ; diastema 16 ; upper tooth-series 27 ; secutor 6·1.

*Hab.* King River, Upper Daly River, Northern Territory.

*Type.* Adult female. B.M. no. 26.3.11.8. Original number 651. Collected 4th November, 1924. Two specimens, adult and immature, the former more or less bleached, the latter in fresh pelage. Also a separate skull, young.

This is a most beautiful little species, the sharply contrasted definition of the shoulder and axillary markings distinguishing it at once from all its allies. It is probably most nearly related to the small form I recently described from Groote Eylandt—*P. longmani*\*,—of which it may be considered a continental representative. But in that species the markings are less contrasted and the general colour is much greyer.

While working out this northern *Petrogale* my attention has been drawn to the characters of various specimens which have been referred to *P. brachyotis* and *P. inornata*. The first of these was described in 1840, and came from Hanover Bay, at the middle of the north-west coast of Kimberley, while the second, dating from 1842, was simply recorded as from the north-west coast of Australia. Specimens from Parry's Creek, at the northern part of the Kimberley coast, were, however, referred in 1909† to *inornata*, so that this may be considered as its typical locality.

The type of *inornata* is no longer in existence, but, accepting the Parry's Creek specimens as representative of it, I find that no characters of any importance separate them from the earlier described *brachyotis*, of which the British Museum contains the typical examples. We may therefore dispose of the name *inornata* as being synonymous with *brachyotis*.

But a number of specimens from the river-area south of Port Darwin in the Northern Territory—Daly, Mary, and S. Alligator Rivers—hitherto referred to *brachyotis* are clearly separable subspecifically, as is, indeed, natural considering the quite considerable difference between the locality concerned. I would propose to term them

*Petrogale brachyotis signata*, subsp. n.

Size and other essential characters as in true *brachyotis*, but the shoulder-markings, instead of being almost obsolete, quite definitely developed—a blackish patch just behind the

\* *Suprà*, p. 186.

† *Ann. & Mag. Nat. Hist.* (8) iii. p. 152 (1909).

axilla, succeeded by a well-defined white vertical streak about an inch in breadth. Hip-markings more perceptible than in *brachyotis*. Front of thighs, above groins, with a vague brown patch some two or three inches in diameter—not visible in true *brachyotis*.

Skull as in *brachyotis*.

Dimensions of the type (measured on skin):—

Head and body 460 mm.; tail 450; hind foot 120; ear 35.

Skull: greatest length 93·5; condylo-basal length 88; zygomatic breadth 51; nasals  $37 \times 15$ ; interorbital breadth 17; diastema 16·3; tooth-series 29; secator 6·8.

*Hab.* Northern Territory in the district drained by the South Alligator River, the Mary River, and the Daly River. Type from the Mary River.

*Type.* Old female. B.M. no. 97.4.12.1. Original number 1225. Collected 14th May, 1895, by Dr. Knut Dahl. Received in exchange from the Oslo Museum. Six specimens, representing all the above localities.

#### PERADORCAS.

From the King River, Northern Territory, and from Milingimbi, Crocodile Islands, in the same region, Capt. Wilkins has sent a number of specimens representing *Peradorcas concinna canescens*, whose distinction from *P. concinna concinna* they entirely confirm.

As before, not one of these specimens is so old that it has ceased to produce additional molars at the hinder end of the tooth-series, as described when the genus was founded. No limit can therefore be set as to the number of molars that may be produced in the animal's life.

A specimen of this genus in the Museum collection now proves to deserve description. It may be described as follows:—

#### *Peradorcas concinna monastria*, subsp. n.

A *Peradorcas* with an ashy-grey fore back and tawny rump.

Size a little larger than in *concinna*. General colour somewhat as in *Petrogale brachyotis signata*, the neck and fore back ashy grey passing posteriorly into brown on the hind back and strongly tawny on the rump and base of tail. Under surface dull buffy whitish, with the bases of the hairs smoky grey. Inguinal region and base of tail below stronger buffy. Shoulder-markings more strongly developed than in other *Peradorcas*, a well-marked black axillary patch,

succeeded by a buffy-whitish streak. Crown dull fawn; median line scarcely perceptible. Ears dull brown. Forearms light cinnamon. Hind limbs buffy cinnamon on the hips, becoming paler and duller below, with very slight terminal darkening. Tail as in *canescens*.

Skull rather larger than in *concinna*, though this may possibly be due to the specimen being older than any other in the collection. Interorbital area strongly narrowing backwards, instead of being more or less parallel-sided.

Dimensions of the type:—

Head and body 350 mm.; tail 335; hind foot 100; ear (dry) 36.

Skull: greatest length 78; condylo-basal length 73; zygomatic breadth 44; nasals  $34 \times 15.3$ ; interorbital constriction 10; palatal length 45.

*Hab.* (of type). Napier, Broome Bay, N.W. Australia.

*Type.* Old female. B.M. no. 10.12.25.4. Original number 14. Collected 10th March, 1910, by G. F. Hill, and presented by the West Australian Museum, Perth.

Readily distinguishable by the contrast between the grey nape and fore back with the tawny or cinnamon rump, and by the greater development of the dark and light shoulder-patches. In some respects the coloration suggests that of *Petrogale brachyotis*, or, at least, of *P. b. signata*, but the tawny rump and the short narrowly pointed hind claws show that the skin is not one of that animal with a misplaced skull.

#### PSEUDOCHIRUS.

During Capt. G. H. Wilkins's expedition to Australia he obtained seven excellent skins of ring-tailed opossums—three from Ebor, in New South Wales, and four from Bloombury, in middle Eastern Queensland. The former agree remarkably well with the type of *Pseudochirus laniginosus*, which, being much faded, is most usefully supplemented by these fresh skins.

But the set from Bloombury differ sufficiently both from the North Queensland *Ps. l. incanens*, described by myself in 1923 from North Queensland, on the one side, and from true *laniginosus* on the other, being approximately equidistant geographically between the two. They would appear to deserve a special subspecific name, which might be

*Pseudochirus laniginosus oralis*, subsp. n.

General colour above more grey than in true *laniginosus*, without the slight tawny wash over the hinder back found in

that form; the grey a deeper and more blackish grey than that of *incanens*, fairly uniform from head to rump, and not or scarcely edged with tawny along the white belly-colour. Head dark grey, but little more tawny round the eyes. Ears with their proectote black, metentote white, more contrasted than in *laniginosus*, and the black extending more on to the crown internal to the ear. In *incanens* there is practically no black, the white proectote very prominent. Arms to wrists rich orange-cinnamon or tawny—approaching “Sanford’s brown” of Ridgway,—deeper and richer than in either *laniginosus* or *incanens*. Outer side of thighs similar, but rather less rich. Hands and feet pale tawny, white or whitish in the other two races. Tail as usual.

Teeth rather smaller than in either of the other forms.

Dimensions of the type:—

Head and body 320 mm.; tail 340; hind foot 53; ear 45.

Skull: upper length 59; condylo-basal length 60; zygomatic breadth 35.5; nasals  $21 \times 11$ ; combined length of four upper molars 13.3.

*Hab.* Middle of eastern coast-region of Queensland. Type from Bloombury, near coast, about  $20^{\circ} 30' S.$  Alt. 300'.

*Type.* Adult male. B.M. no. 26. 3. 11. 28. Original number 489. Collected 10th July, 1924, by Capt. G. H. Wilkins. Four specimens.

In this subspecies the tawny or cinnamon of the limbs is more restricted in area than in *laniginosus*, but stronger and more intense than in either of the other forms, while the blackening on the ears and round the sides of the head is also characteristic. The grey of the back is less silvery than in *incanens*, deeper and more intense than in *laniginosus*, in which there is a tawny wash on the back.

*Pseudochirus laniginosus modestus*, sp. n.

A very uniformly coloured race, without marked contrasts on head or limbs.

General colour above a plain pinkish brown, nearest to “cinnamon-drab,” this colour covering equally the head, body, and limbs, without any of the usual grey tone of the fore back or the contrasted tawny colour of the limbs. Sides drabby, like back, the drab extending on to the sides of the belly, and narrowing unusually the dull whitish of the under surface; inguinal region not tawny. Head quite like body, but the ears have something of the usual coloration, the proectote blackish and the metectote whitish, though the contrasts are less conspicuous than in *laniginosus*. Forearms and hips

outside quite like the back and sides, or with a very faint warmer tinge. Hands and feet pale drabby. Tail drabby like body, the usual darkening towards the white of the tip but little evident; about one-third of the end white.

Dimensions of the type (measured on the skin):—

Head and body 310 mm.; tail 345; hind foot 46.

*Hab.* Inland regions of northern New South Wales. Type from St. George's River.

*Type.* Adult male. B.M. no. 26.3.11.37. Original number 764. Collected October 1924.

This seems to be a dull inland race in which all the usual colour-contrasts are reduced or suppressed.

### TRICHOSURUS.

Capt. Wilkins obtained a considerable number of Phalangera at the various localities he worked in, so that with those already in the Museum we have over seventy specimens from Queensland and New South Wales alone. On laying these out geographically, it is interesting to observe what local variation occurs among them.

Commencing with New South Wales, and also in southern Queensland (Gin-gin, near Bundaberg, Westwood, near Rockhampton, Eidsvold, and Mundubbeira), we have the typical *T. vulpecula*, normally grey, with a very bushy black tail, while at the opposite, northern, end of the series (Cooktown, Ravenshoe, Bellenden-Ker, Herbert River) we have *T. vulpecula johnstoni*, Ramsay, which is generally strongly suffused with coppery, or wholly coppery, although a few grey specimens without coppery occur. The tail of this race is inclined to be long, and is fairly bushy, though not so much so as in true *vulpecula*, more tapering and less cylindrical.

But between these two races (Townsville, Inkerman, Bloombury) the Phalangera, while of the same grey as in *vulpecula*, not coppery as in *johnstoni*, have noticeably shorter, more slender, and more tapering tails, the breadth of this organ at the middle about 30–35 mm. only, while even in summer specimens of *vulpecula* it is from 40–55 mm. in breadth and is approximately cylindrical. This intermediate race might be called *Trichosurus vulpecula mesurus*.

Other characters as in *vulpecula*, though the fur is a little less rich. Skull also quite similar.

Dimensions of type:—

Head and body 435 mm.; tail 256; hind foot 157; ear 60.

Skull: greatest length 79.

*Hab.* (of type). Inkerman, N. Queensland, 19° 40' S.



*Type.* Adult female. B.M. no. 8.8.8.114. Original number 436. Collected 10th September, 1907, by W. Stalker. Presented by Sir William Ingram and the Hon. John Forrest. Twenty specimens examined.

To recapitulate the geographical distribution of the three forms, *T. v. johnstoni* occurs from 15° 10' S. lat. to 18° 30', *mesurus* from 18° 30' to 21°, and *vulpecula* from 22° southwards, all along the coast-land and dividing ranges of Eastern Queensland.

*Phascogale minutissima sinualis*, subsp. n.

Essential characters of size and tooth-structure quite as in true *minutissima* of S. Queensland, but the colour, instead of the *Mus musculus*-like hues of the type-form, is rather paler above, a clearer greyish, and much paler below—in fact, nearly white,—though the hairs are still slaty basally. Hands and feet also whitish.

Dimensions of the type (immature, measured on the spirit-specimen) :—

Head and body 52·5 ; tail 47 ; hind foot 10 ; ear 8.

Skull : greatest length 17·3 ; combined length of  $m^{1-3}$  3·9.

*Hab.* Groote Eylandt, Gulf of Carpentaria.

*Type.* Immature male, with milk  $p^4$  still in place. B.M. no. 26.3.11.194. Original number 737. Collected 19th January, 1925.

This is a great extension of the known range of *Ph. minutissima*, which appears to have only been recorded from the southern half of Queensland. But I see no differences of more than subspecific value in the single Groote Eylandt specimen, which is, however, unfortunately immature. The development of the milk-seccator is just as in true *minutissima*.

*Pseudomys (Leggadina) delicatulus mimulus*, subsp. n.

Essential characters as in *delicatulus* of the Northern Territory, but the general colour much more sombre, of about the tone of the ordinary small grey *Melomys* of this region, the head and back olivaceous mouse-colour, the rump becoming dark tawny. Under surface soiled greyish, the hairs slaty basally, dull buffy terminally ; line of demarcation on sides not sharply contrasted. Ears dark brown. Hands and feet whitish. Tail pale brown, dull whitish below.

Skull apparently as in true *delicatulus*.

Dimensions of the type :—

Head and body 65 mm. ; tail 69 ; hind foot 17·5 ; ear 11·5.

Skull : greatest length 21·4 ; condylo-incisive length 19 ;

nasals 7 ; interorbital breadth 3·5 ; breadth of brain-case 10 ; upper molar series 3·8.

A spirit-specimen measures :—

Head and body 58 mm. ; tail 66 ; hind foot 16·8 ; ear 11·5.

*Hab.* Groote Eylandt, Gulf of Carpentaria.

*Type.* Adult female. B.M. no. 26. 3. 11. 174. Original number 716. Collected 6th March, 1925, by Capt. G. H. Wilkins. Two specimens, the paratype preserved in spirit.

The coloration of this island mouse is curiously like that so common in *Melomys*, olivaceous grey-brown with rufous rump—very different from that of the uniformly sandy-coloured, white-bellied, typical *delicatus*.

#### LXXVII.—*On some Mammals from the Middle Amazons.*

By OLDFIELD THOMAS.

THE British Museum has acquired a number of mammals collected by Herr W. Ehrhardt on the Solimoens, Middle Amazons, just above Manaus, and among these I find several worthy of note.

#### THE GIANT AMAZONIAN SQUIRRELS OF THE SUBGENUS *UROSCIURUS*.

The Ehrhardt collection contains six specimens of this group, two each of three different forms, from three localities, those of each locality being quite identical with each other.

From Canabouca, Parana de Jacaré, about 120 km. S.W. of Manaus, on the southern side of the Solimoens, there are two examples of *S. pyrrhonotus*, Wagn., closely agreeing with the good series we have from Humayta, on the Madeira, the type-locality being Borba, near the mouth of the same river.

Then from Ayapua, about 300 km. S.W. of Manaus, there are a couple which, in the puzzling manner shown by these squirrels, more nearly agree with specimens in the Museum from farther to the east, at Santarem and on the River Tapajos. This form seems so distinct as to deserve subspecific distinction.

*Sciurus (Urosciurus) pyrrhonotus taparius*, subsp. n.

General colour darker throughout than in true *pyrrhonotus*. Forehead and crown more distinctly blackened. Greater part of back dark grizzled black and buffy. Rump gradually

becoming deep rich rufous, which extends down the hind limbs to the feet, the tone of a much deeper and more chestnut colour than the splendid rufous of *pyrrhonotus*. The red, however, does not begin on the back so soon as in *pyrrhonotus*, the grizzled part continuing to the rump. Under surface wholly white, sharply defined on sides. Ears red, the proectote partly blackish. Tail not so greatly developed as in *pyrrhonotus*, usually with a rather longer black base.

Skull large and with heavy muzzle.

Dimensions of the type:—

Head and body 295 mm.; tail (c.) 320; hind foot 61.

Skull, greatest length 65, condylo-incisive length 59.5; upper tooth-series 10.5.

*Hab.* Lower Amazons. *Type* from Urucurituba, Santarem; other specimens from Villa Braga, Rio Tapajoz (*E. Snethlage*), and Ayapua, Lower Rio Purus (*W. Ehrhardt*).

*Type.* Adult female. B.M. no. 8. 5. 9. 26. Original number 25. Collected 11th February, 1906, by W. Hoffmann. Four specimens.

This squirrel tends to approach in coloration the more grizzled form characteristic of the Madeira river-basin.

Allied to this is a still darker form from the Jurua River:—

*Sciurus pyrrhonotus juralis*, subsp. n.

General coloration similar to that of *taparius*, but even darker, the grizzled back more strongly blackish, the buffy tips of the hairs quite minute. Crown blackish. Ears brown rather than red. Back of hips and hind limbs dark chestnut, darker than in *taparius*. Fore limbs scarcely rufous, the general effect a dark reddish brown. Tail about as in *taparius*.

Skull with a long slender snout.

Dimensions of the type:—

Head and body 315 mm.; tail 320; hind foot (c.) 63.

Skull, greatest length 68, condylo-incisive length 61, upper tooth-series 9.4.

*Hab.* Jurua River.

*Type.* Adult male. B.M. no. 3. 9. 1. 12. Original number 714. Collected February 1902 by Herr Garbe. Presented by the São Paulo Museum.

This is the darkest-coloured member of the group; its white belly shows that the specimen is not melanoid.

In the slenderness of its muzzle the skull differs considerably from that of the Tapajoz *pyrrhonotus*, but of the taxonomic value of this character I am by no means sure.

Finally, Herr Ehrhardt obtained two specimens of a red-bellied member of the group, perhaps more splendid in its coloration than any other. Another specimen of the same form had been collected by Fräulein Snethlage in the same region in 1916, and was then referred by me to *S. pyrrhonotus*; but, for whatever the distinctions are worth, it certainly appears more nearly allied to *S. igniventris*, of which it may be treated as a subspecies.

*Sciurus igniventris fulminatus*, subsp. n.

Like true *igniventris* by its reddish crown and red under surface, but the upper surface is nearly wholly rich chestnut-rufous, with but the very slightest trace of grizzling across the shoulders, and no buffy tips to the dorsal hairs. Under surface rich ochraceous, paler than the deep red of *igniventris*. Crown dark red, ears clearer red. Hips and hind legs deep rich red; forearms, hands, and hind feet paler, ochraceous red. Tail very bushy, its extreme base rufous, its next two-fifths black, the bases of the hairs buffy-ringed; the remainder brilliant ochreous-rufous, the hairs of this colour to their roots, instead of being black at base as in *igniventris*. There is, however, a middle ring of a slightly deeper shade of rufous.

Dimensions of the type, measured by Fräulein Snethlage in the flesh:—

Head and body 252 mm.; tail 293; hind foot 65, ear 31.

*Hab.* Lower Rio Negro. Type from Manacapuru. Other specimens from Kastaneiro Miri, 200 miles further to the north-west.

*Type.* Adult male. B.M. no. 20.7.1.1. Original number 84. Collected 12th March, 1916, by Fräulein E. Snethlage, and presented by the Para Museum.

By its general red colour, its red belly, and its splendid unicolor ochraceous tail-brush this squirrel surpasses any other member of the present showy group.

Occurring on the same river as *igniventris* (type-locality Marabitanos), I have thought it best to treat it as a subspecies of that animal in spite of its very considerable difference in colour.

THE ACOUCHIS OF THE *MYOPROCTA PRATTI* GROUP.

Herr Ehrhardt has sent six specimens of the green acouchis (*Myoprocta pratti*), and these, like the squirrels, seem to be referable to several local races.

The first of these animals known from this region was the

one obtained by Fräulein Snethlage at Acajutuba, on the lower Rio Negro \*, and described by me as *Myoprocta pratti limana* †. With this there precisely agree three skins from the Lago da Arara, in the angle between the Negro and the Solimoens, on the north side of the latter river. The deep olivaceous colour, scarcely warmer on the hinder back, the long rich orange postauricular streaks, the well-haired belly, rich orange-coloured, the colour especially brilliant on the front of the thighs, and the sharp definition of such white as there is down the median ventral line are all similar in the examples from these two localities. In the skull, the size is the same, and both bullæ and teeth are comparatively small.

Contrasted with this, the following animal from south of the Solimoens may be described as

*Myoprocta pratti caymanum*, subsp. n.

Size rather greater than in *limana*. General colour above olivaceous with even less reddish suffusion on the rump—indeed, practically none. Under surface very thinly haired, the lower belly and inner side of thighs almost naked; yellow, not sharply defined laterally, the centre line whitish, not sharply contrasted. Crown grizzled black and ochraceous; postauricular stripes well developed, deep ochraceous.

Skull of type, although less aged than in the examples of *limana*, larger than any of the latter.

Cheek-teeth decidedly larger than in *limana*, in which they seem to be quite constant. Front of incisors of a paler yellow than the deep orange of *limana*.

Dimensions of the type, measured on the skin:—

Head and body 370 mm.; tail 61; hind foot 80.

Skull, greatest length 80; condylo-incisive length 67·3; zygomatic breadth 37·5; length of bulla 15; upper tooth-series, alveoli 13·5, crowns 13.

*Hub.* Canabouca, Parana do Jacaré, south side of the Solimoens, about 120 km. to the south-west of Manaus.

*Type.* Young adult female. B.M. no. 26.5.5.42. Original number 843. Collected 15th November, 1925.

Distinguished mainly by the decidedly greater size of the teeth.

Finally, also on the south side of the Solimoens, but to the west of the Purus, there occurs

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\* Further up the Rio Negro river there occurs a *Myoprocta*, called by Wagner *Dasyprocta leptura*, which by its red colour and darkened back would seem to be referable to the real Guianan *Acouchi*.

† Ann. & Mag. Nat. Hist. (9) vi. p. 279 (1920).

*Myoprocta pratti puralis*, subsp. n.

Size as in *limana*. General colour above olivaceous, but the rump and hams with a stronger suffusion of rufous. Under surface thinly haired, dull yellowish, not sharply contrasted or defined, the median area inconspicuously washed with whitish. Front of thighs dull ochraceous, less brilliant than in *limana*. Postauricular streaks shorter, duller, and less conspicuous than in either of the other forms.

Skull much like that of *limana*, the bullæ a little larger.

Dimensions of the type, measured on skin :—

Head and body 330 mm. ; tail 58 ; hind foot 77.

Skull, greatest length 74 ; condylo-incisive length 63·5 ; zygomatic breadth 84 ; length of bulla 14·6 ; upper tooth-series, alveoli 12·6, crowns 12·3.

*Hab.* Angle between the Purus and Solimoens. Type from Ayapua, about 300 km. S.W. of Manaos.

*Type.* Adult female. B.M. no. 26.5.5.41. Original number 305. Collected 8th October, 1925. Two specimens.

Distinguishable from *caymanum* by lesser size and smaller teeth, and from both the other forms by the reddish suffusion on the rump and the less development of the postauricular streaks. But the dark reddish on the rump is a mere suffusion, and in no way comparable to the general deep rich rufous found in *M. acouchy*.

The definition of the original "*Cavia acouchy*" by Erxleben as "*corpore olivaceo*" might give rise to the idea that his animal was merely one of the greenish acouchis of the *M. pratti* group, and not the reddish species of Guiana at all. But I have been able to examine the early references he gives, those of both Des Marchais and Barrère, on which in turn Buffon's account was based, and it is quite clear that the species referred to was the reddish acouchi of Cayenne. As a matter of fact, many specimens of this animal are of a somewhat olivaceous tone, which, in the absence of *D. pratti*, might easily justify the word being applied to them.

LXXVIII.—*Two new Subspecies of Callosciurus quinquestriatus.* By OLDFIELD THOMAS.

AMONG a further collection of mammals obtained in Kachin by Mr. George Forrest, and presented to the National Museum by Lord Rothschild, there occurs a squirrel belonging to the rare *Callosciurus quinquestriatus* of Blamo,

but representing a new subspecies of it, and in working this out I find that one of the same group collected by Mr. Kingdon Ward also deserves distinction.

*Callosciurus quinquestriatus*, Anderson, typical form.

Seven specimens of this peculiar striped-bellied Squirrel from Bhamo and neighbourhood, while varying in the intensity and breadth of the white on the underside, are fairly uniform in the antero-posterior extension of the stripes. The white runs forward to the hinder neck and on to the under surface of the forearms, and posteriorly to the inguinal region and on to the inner end of the hind legs, sometimes reaching the ankles. The median dark line begins on the middle of the chest and ends before the inguinal region, while the lateral black stripes are restricted to the area behind the axillæ and in front of the hips.

In contrast with this the specimen collected by Mr. Kingdon Ward differs in the considerably greater extent of the black stripes, and may be described as follows:—

*Callosciurus quinquestriatus imarius*, subsp. n.

General colour above as usual, or rather less suffused with cinnamon. Ear-edges less ochraceous. Upper surface of both fore and hind limbs more smoky grey. Under surface darker throughout, the chin and throat smoky greyish, the white lines of the belly narrow, not extending in front of the sternum, and posteriorly becoming almost obsolescent in the inguinal region; at their maximum they are only of about the same breadth as the median dark line, the latter extending backwards on to the scrotum. Lateral dark lines broad and prominent, black, extending forwards in continuation with the blackish underside of the fore limbs and backwards down the inner side of the legs. Fore and hind digits blackened. Tail as in *quinquestriatus*.

Dimensions of the type, measured on skin:—

Head and body 255 mm.; tail 230; hind foot 49.

Skull, greatest length 52·6, condylo-basal length 48.

*Hab.* Kachin Province, Northern Burma. Type from the west flank of Imaw Bum Mountain, 26° 10' N., 98° 30' E. Altitude 7000'.

*Type.* Adult male. B.M. no. 20.8.7.6. Original number 20. Collected 21st October, 1919, by F. Kingdon Ward, and presented by the Bombay Natural History Society.

This squirrel is obviously a darkened local subspecies of *C. quinquestriatus*, differing in the greater extent and

intensity of the dark lower markings, and especially of the lateral ventral lines. It was referred to, but not distinguished, in my paper on Mr. Kingdon Ward's Kachin collection of 1919\*.

On the other hand, the following race differs in exactly the opposite direction from the typical form :—

*Callosciurus quinquestriatus sylvester*, subsp. n.

General coloration above olivaceous, of a less warm tone than in true *quinquestriatus*. Light area below suffused with buffy anteriorly, quite white on belly, its extension forwards about as *quinquestriatus*. Dark stripes much suppressed, the median one grey-mixed, narrow, commencing on the chest and ending on the belly short of the inguinal region; the lateral ones absent or just faintly perceptible. Inguinal region and inner side of hind legs broadly washed with cinnamon. Ears coloured like head, scarcely more buffy. Hands and feet darkened terminally.

Dimensions of the type, measured on skin :—

Head and body 225 mm. ; hind foot 48.

*Hab.* W. Yunnan; type from the Schweli-Salween divide. Alt. 9000'.

*Type.* Adult male. B.M. no. 25. 10. 5. 31. Original number 1032. Collected September 1925 by Mr. George Forrest and presented by Lord Rothschild.

Readily distinguishable by the practical obsolescence of the lateral ventral black stripes.

LXXIX.—*Nouveaux Bagous d'Asie (Coleoptera, Curculionidæ)*. Par A. HUSTACHE.

*Bagous humeridens*, sp. n.

Brun-noir, les tibias et les tarses ferrugineux, les élytres pourvus de deux tubercules, l'un sur l'épaule, saillant et dirigé en arrière, le 2<sup>e</sup> remarquablement fort, conique, sur le 5<sup>e</sup> interstrie et au sommet de la déclivité postérieure.

Rostre aussi long que le prothorax, arqué, pourvu d'un sillon latéral au-dessus du scrobe. Front fovéolé. Antennes ferrugineuses, la massue pubescente et foncée. Prothorax étroit, subcylindrique, légèrement dilaté vers le tiers antérieur, faiblement étranglé derrière le bord antérieur; disque

\* Journ. Bombay N. II. Soc. xxvii. p. 502 (1921).



inégal, transversalement ondulé dans le milieu ; pourvu de trois bandes de squamules jaunâtres, la médiane étroite. Elytres très larges, presque trois fois aussi larges ensemble que le prothorax, plans sur le disque, rectangulaires, brusquement, très fortement rétrécis et à déclivité presque verticale derrière les gros tubercules, les épaules coupées très obliquement en avant et prolongées en arrière par un fort tubercule conique et obtus ; stries étroites, leurs points peu visibles ; interstries larges, peu convexes en avant, plus fortement en arrière, le 3e un peu gibbeux, subtuberculé et le 5e pourvu d'un gros tubercule au sommet de la déclivité. Pattes élancées ; tibias bisinués et ciliés en dedans ; tarses allongés, étroits, de même largeur, tous les articles plus longs que larges.

Long. 3.5 mm.

CAMBODGE : Kompong-Kédey, types (ma coll.). BENGAL : Dacca (coll. British Museum).

Les tubercules huméraux et apicaux caractérisent bien cette espèce.

*Bagous siamensis*, sp. n.

Court, noir, les tarses ferrugineux, le revêtement compact, jaunâtre, les élytres avec une fascie postmédiane cendrée irrégulière, chaque élytre pourvu en arrière de quatre nodosités arrondies, deux sur le 3e interstrie, les plus grosses, deux sur le 5e interstrie et placées en arrière des précédentes.

Rostre plus court (♂) ou aussi long (♀) que le prothorax, arqué. Antennes ferrugineuses. Prothorax un peu plus large que long, pourvu sur les côtés, vers le tiers antérieur d'un tubercule obtus, assez fortement rétréci en avant de ce tubercule et le bord antérieur relevé, les côtés parallèles de la base au tubercule antérieur ; le disque inégal, pourvu d'un large sillon médian plus profond à la base. Elytres subrectangulaires, ou double aussi larges que le prothorax, une fois et demie aussi longs que larges entre les épaules, les côtés parallèles jusqu'au tiers postérieur, les épaules en angle obtus brièvement arrondi et légèrement saillantes latéralement, la déclivité postérieure presque verticale ; rétrécis et brièvement arrondis ensemble au sommet ; le dos presque plan avec une impression transversale arquée en avant du milieu ; stries fines, non ponctuées ; interstries pairs plans ; interstries impairs irrégulièrement convexes, la suture fortement relevée au sommet de la déclivité postérieure, le 3e interstrie plus fortement relevé derrière la base, sa 1ère nodosité, en forme de tubercule obtus, placée vers le milieu, la 2e

moins élevée au sommet de la déclivité, le 7<sup>e</sup> interstrie irrégulièrement convexe et avec quelques très petites nodosités. Tibias arqués, fortement bisinués en dedans et pourvus sur leur tranche interne de 2-3 denticules courts, aigus et ciliés. Tarses très courts, les 4 articles ensemble moins longs que la moitié du tibia, les deux premiers de même largeur, courts, le 2<sup>e</sup> transversal, le 3<sup>e</sup> plus large, non bilobé, triangulaire et seulement aussi long que large.

Long. 2.5-2.6 mm.

SIAM (sans localité précise) : cinq exemplaires (*Bowring*, British Museum).

*Bagous vicinus*, sp. n.

Noir, les antennes (moins la massue), les tibias et les tarses ferrugineux, revêtu de squamules serrées, petites, granuleuses, le prothorax avec une bande latérale et les élytres avec de petites macules cendrées, ces macules plus nombreuses sur les côtés, et l'une d'elles plus grande, arrondie au sommet du 3<sup>e</sup> interstrie.

Rostre à peine aussi long que le prothorax. Prothorax transversal, arqué sur les côtés, le sillon médian étroit, plus profond à ses extrémités, le bord antérieur relevé, les granules plus gros que ceux des élytres. Écusson arrondi, bien visible. Elytres subrectangulaires, plus longs que larges, parallèles jusqu'au milieu, brièvement rétrécis et arrondis ensemble au sommet, les épaules en angle obtus; peu convexes sur le dos, la déclivité postérieure forte; stries fines, à points indistincts; interstries subplans, le 3<sup>e</sup> à calus apical petit. Tibias modérément bisinués, leur tranche interne lisse, sans granules râpeux et pourvue seulement de 3-4 cils excessivement courts. Tarses peu allongés, les deux premiers articles de même largeur, le 1<sup>er</sup> conique et plus long que large, le 2<sup>e</sup> court, aussi long (♂) ou à peine plus long (♀) que large, le 3<sup>e</sup> un peu plus large, non bilobé et seulement aussi long que large, le 4<sup>e</sup> visiblement moins long que les trois précédents ensemble.

Long. 2.1-2.5 mm.

Cette espèce a la plus grande ressemblance avec *B. subcarinatus*, Gyll.; elle en diffère par le prothorax plus court, moins rétréci en avant, les élytres un peu plus longs, plus rectangulaires, moins convexes, le calus apical du 3<sup>e</sup> interstrie moins élevé, les tibias plus grêles et surtout par les tarses plus étroits, le 3<sup>e</sup> article visiblement plus large que les précédents.

INDE CENTRALE : Kurda près Mhow (ex *E. Cordier*), deux

exemplaires, types (ma collection). UNITED PROV.: Kumaon, Haldwani Div. (*H. G. Champion*), deux exemplaires (British Museum).

*Bagous brunneus*, sp. n.

Allongé, d'un brun ferrugineux, les pattes et les antennes plus claires, revêtu de fines squamules plates, serrées, visiblement ponctuées à leur centre, d'un jaune grisâtre.

Rostre plus court que le prothorax, épais, fortement arqué, rougeâtre, ponctué. Squamules de la tête plus petites que celles du prothorax, le front plan, fovéolé. Prothorax cylindrique, plus long que large, faiblement rétréci dans son cinquième antérieur, les angles postérieurs droits, les côtés parallèles; convexe, le bord antérieur un peu relevé, le sillon médian très étroit et squamulé; couvert de granules squamulés assez gros et très serrés. Elytres d'un quart plus larges que le prothorax, parallèles jusqu'au milieu, assez brièvement arrondis ensemble au sommet, les épaules obliques et peu marquées; dos peu convexe, les stries visiblement ponctuées, les interstries d'égale et faible convexité, le 5e très légèrement calleux à son sommet, le 3e vers le milieu, les 5e et 6e en avant du milieu avec une tache allongée et plus claire. Pattes allongées; tibias minces, bisinués et lisses en dedans, courbés en dedans au sommet; tarses courts, les deux premiers articles de même largeur, le 2e oblong, à peine plus long que large, le 3e triangulaire, beaucoup plus large, non bilobé, le 4e plus court que les trois précédents réunis.

Long. 3 mm.

TONKIN: Hanoi (*C. Nodier*), un exemplaire (ma collection).

*Bagous ovoideus*, sp. n.

Oblong, étroit, le revêtement grisâtre, les squamules peu distinctes; d'un noir brun, les pattes et les antennes d'un ferrugineux foncé.

Rostre gros, plus court que le prothorax, fortement arqué. Prothorax grand, peu plus étroit que les élytres, aussi long que large, assez fortement rétréci dans son tiers antérieur et brièvement en arrière, les côtés légèrement arqués-divergents de la base au tiers antérieur, les angles postérieurs obtus et arrondis; fortement convexe, l'impression transversale antérieure large et assez profonde; sans sillon médian; densément granulé, les granules médiocres. Elytres peu plus larges que le prothorax, en demi ovale, graduellement rétrécies dès les épaules, un peu plus fortement en arrière, brièvement arrondies ensemble au sommet, les épaules obliques et assez

élevées ; convexes, les stries peu distinctement ponctuées, les interstries avec 2-3 rangs de petits granules, les impairs légèrement relevés, sans calus apical. Pattes robustes, les tibias larges, les antérieurs, en dedans, peu flexueux, indistinctement granules mais pourvus d'un rang de cils très courts ; tarses larges et très courts, le 2e article transversal, le 3e beaucoup plus large et bilobé.

Long. 2.5 mm.

INDE : Malabar, deux spécimens (ma collection).

*Bagous affinis*, sp. n.

Espèce très-voisine de *B. sulciollis*, Hartm., décrite de Chine ; elle a la même coloration et n'en diffère que par les caractères suivants :—Prothorax visiblement plus long que large. Elytres un peu plus longs et un peu plus étroites, les épaules plus obliques en avant. Tibias, et en particulier les antérieurs, lisses en dedans, munis seulement de quelques cils, sans aucun granule râpeux. Troisième article des tarses un peu plus large que le 2e.

BENGAL : Sarda (*F. W. Champion*), dix spécimens (British Museum).

*B. sulciollis* et *affinis* ont un sillon latéral au rostre devant l'œil, caractère indiqué par Faust pour *B. compertus*, Faust, décrite des Indes orientales, mais les autres caractères de *compertus*, Fat., ne conviennent pas à notre espèce.

*Bagous nodieri*, sp. n.

Très petit, brun, les pattes et les antennes (massue foncée exceptée) ferrugineuses, les fémurs parfois rembrunis, revêtu d'une couche de squamuleuses d'un gris jaunâtre.

Rostre aussi long que le prothorax, cylindrique, peu arqué, ponctué et brillant. Prothorax cylindrique, plus large que long, faiblement rétréci dans son tiers antérieur, ses côtés parallèles en arrière, convexe, faiblement impressionné transversalement en avant, le sillon médian étroit et peu distinct, densément granulé. Elytres subrectangulaires, une fois et demie aussi larges que le prothorax ; les épaules presque en angle droit, brièvement arrondies ; parallèles jusqu'au milieu, rétrécis en arrière et largement arrondis ensemble au sommet ; dos un peu déprimé ; stries fines, leurs points indistincts ; interstries légèrement convexes, sans calus apical. Pattes élancées ; tibias minces, bisinués et lisses en dedans ; tarses courts, les deux premiers articles de même largeur, le 1er un peu plus long, le 2e seulement aussi long que large, le 3e

entier, un peu plus large que le 2e et seulement aussi long que large, le 4e presque aussi long que les trois précédents réunis.

Long. 1.2-1.6 mm.

TONKIN: Hanoi (C. Nodier), quatre spécimens (ma collection).

*Bagous luteitarsi*, sp. n.

Noir, les antennes et les tarsi jaunes, revêtu de squamules d'un gris jaunâtre et cendrées, ces dernières formant sur les interstries impaires des petites taches cendrées, rectangulaires, alternant avec des taches foncées, le prothorax avec trois bandes cendrées, la médiane étroite. Tarsi courts, les 4 articles ensemble aussi longs que la moitié du tibia, les trois premiers graduellement mais faiblement élargis, le 1er conique et plus long que large, le 2e triangulaire et aussi long que large, le 3e faiblement transversal et entier, le 4e presque aussi long que les trois articles précédents ensemble.

Rostre arqué, à peine aussi long que le prothorax, densément squamulé, à fine pubescence en dessous. Tête convexe, ses squamules à peine plus petites que celles du prothorax. Antennes entièrement rousses, la massue pubescente, ovale, à peine plus foncée. Prothorax à peine plus large que long, médiocrement resserré sur son tiers antérieur, le bord antérieur légèrement relevé, la base tronquée, rectiligne, les angles postérieurs légèrement obtus, les côtés rectilignes et faiblement divergents de la base au milieu, sa plus grande largeur au milieu; modérément convexe, sans sillon médian, l'impression transversale antérieure assez forte.

Elytres de un tiers plus larges que le prothorax, une fois et demie aussi longues que larges ensemble, échancrées en arc à la base, les épaules arrondies mais saillantes latéralement, les côtés graduellement mais faiblement arqués jusqu'au milieu, plus fortement en arrière, brusquement rétrécis près du sommet, ce dernier un peu prolongé en forme de bec arrondi; stries fines, leurs points indistincts; squamules des interstries placées sur 3 ou 4 rangs; interstries paires plans, les impaires légèrement convexes, pourvus de très faibles nodosités cendrées terminées par une très courte soie. Pattes robustes squamulées et brièvement sétulosées; tibias épais et presque droits, non râpeux en dedans, munis de quelques cils très courts.

Long. 2.5-2.7 mm.

RENGALE: Sarda (F. W. Champion), quatre spécimens (British Museum).

Par son dessin elytral cette espèce ressemble un peu à *B. chevrolati*, Tourn., mais les épaules débordant la base du prothorax la rangent parmi les *Bagous*, s. st. ; elle se distingue aisément par l'absence complète de calus au sommet des 3e et 5e interstries.

*Bagous tonkinianus*, sp. n.

Revêtement dorsal dense jaunâtre, ou brun-gris, le prothorax avec deux bandes médianes dénudées, larges à la base, se rétrécissant en avant, étroitement séparées par une ligne squamulée, jaunâtre. Tibias antérieurs pourvus en dedans de 2-3 assez forts denticules ciliés. Tarses assez courts, les articles ensemble à peu près aussi longs que la moitié du tibia, les trois premiers de même largeur, le 1er plus long que large, les 2e et 3e seulement aussi longs que larges.

Rostre aussi long que le prothorax, fortement arqué, densément squamulé (sauf au sommet) ainsi que la tête, cette dernière convexe. Antennes d'un brun de poix, la massue foncée. Prothorax aussi long que large, assez fortement rétréci dans son quart antérieur, sa plus grande largeur vers son tiers antérieur, les côtés arqués en arrière, les angles postérieurs obtusément arrondis ; disque un peu inégal, l'impression transversale antérieure moyennement forte, le bord antérieur légèrement relevé, avec un sillon médian large, peu profond ; ponctué granulé. Elytres subrectangulaires, légèrement rétrécis jusqu'au tiers postérieur, puis brusquement rétrécis, impressionnés derrière le calus apical et brièvement arrondis ensemble au sommet ; de  $\frac{1}{4}$  plus larges que le prothorax, les épaules peu saillantes, en angle obtus et arrondi, peu obliquement coupées en avant ; disque déprimé, impressionné en arc vers le  $\frac{1}{4}$  antérieur, les stries fines, leurs points peu distincts ; interstries pairs plans, le 2e déprimé ; interstries impairs convexes, en partie dénudés, le 3e à taches alternées claires et foncées, ces dernières plus élevées, la suture un peu relevée et un peu élargie au sommet de la déolivité postérieure, le 5e à calus obsolète ; revêtus d'une couche compacte, un peu brillante, de squamules serrées. Pattes sans soies ; tous les tibias roux, flexueux, arqués en dedans au sommet, et les antérieurs et intermédiaires pourvus de 2-3 denticules ciliés, les postérieurs seulement de 2-3 cils.

Long. 2.5-2.9 mm.

TONKIN : Pnom Penh, type (ma collection).

Cette espèce, voisine de *B. sumatrensis*, Faust, en diffère par l'absence de calus au sommet du 5e interstrie.

LXXX.—*A few new African Species of Cetoniine Coleoptera.*

By GILBERT J. ARROW.

THE following are some of the more interesting recent acquisitions belonging to the subfamily Cetoniinæ in the British Museum collection. The two first described are remarkable for their extreme flatness, an evident adaptation for lurking under loosened bark. The closer the bark beneath which such an insect is able to squeeze itself the better it is able to elude foes of a size to threaten its life, and individuals possessing this advantage have obviously been favoured in the struggle for existence.

*Placodidus monstrosus*, sp. n.

Totus fusco-niger, opacus, valde deplanatus, paulo elongatus, tarsis valde abbreviatis, solidis: capite denso et confluent punctato, clypei margine antico fore recto, leviter reflexo; pronoto grossius, medio reticulatim, punctato, illic leviter impresso, lateribus ante medium fortiter sed haud acute angulatis, postice valde contractis, ante basin acute tuberculatis: elytris longitudinaliter vermiculatis, vix perspicue costatis, modice latis, parallelis: pygidio dense varioloso, inflexo, postice fortiter carinato: corpore subtus toto opaco, reticulato, spiraculo ultimo conico: pedibus scabrosis, tibia antica arcuata, extus minute tridentata, tibiis 4 posterioribus extus acute unidentatis, apice paulo dilatatis.

Long. 13 mm.; lat. max. 6 mm.

TANGANYIKA TERRITORY: Dodoma (*H. L. Andrewes*).

The unique specimen is a male, as shown by its horizontally reflexed pygidium.

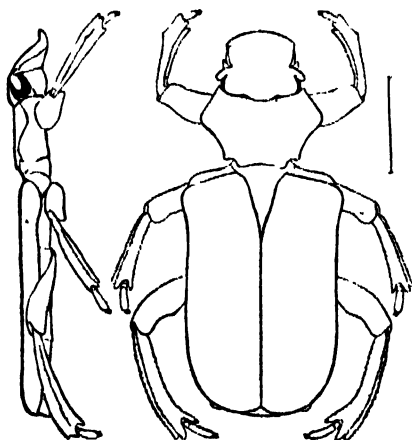
This and the following new species agree with the only hitherto known form of the genus, *P. compransor*, Péringuey, in their extraordinary flatness, the body in the present species measuring 2 mm. in thickness; but they differ considerably in the absence of the strong elytral costæ of *P. compransor* and the shorter tarsi. *P. monstrosus* approaches nearer to that insect in its broader form as well as in the toothing of the tibiæ, but the front tibiæ are rather strongly curved and the three teeth very minute. The hind tibia dilates strongly from base to apex and bears a strong tooth externally. The entire surface is closely sculptured, the head and pronotum with close, partially confluent, punctures and the elytra and lower surface with a fine tracery of raised lines running longitudinally. The front margin of the clypeus is almost straight and not much reflexed, and the

pronotum is nearly twice as broad as it is long and has a depression in the middle.

*Placodidus planissimus*, sp. n.

Totus fusco-niger, opacus, maxime deplanatus, elongatus, pedibus latis, tarsis brevissimis, solidis: capite et pronoto crebre reticulatis, clypei margine antico valde reflexo, arcuato: prothorace quam capite breviori, lateribus ante medium sat acute angulatis, postico valde contractis, prope basin acute tuberculatis: elytris longitudinaliter vermiculatis, haud costatis, oblongis, parallelis, pygidio brevissimo, verticali, dense transversim striolato, corpore subtus toto opaco, reticulato, spiraculo ultimo conico: pedibus scabrosis, tibia antica arcuata, extus ante apicem obtuse unidentata, pedibus posticis sat elongatis, tibiis paulo dilatatis, leviter bisinuatis.

Long. 13 mm.; lat. max. 5 mm.



*Placodidus planissimus*, dorsal and lateral aspects,  $\times 5$ .

S. RHODESIA: Lukosi.

A single specimen has been presented by the Imperial Bureau of Entomology. It is a female and has the pygidium vertical, very short and flat, not bent inwards as in the male of the species just described. *P. planissimus* is narrower in form and a little flatter than *P. montrosus*, the body being little more than 1 mm. thick. The tarsi are shorter than those of *P. montrosus*, the front tibiae are shorter and broader, with only a single very obtuse external tooth, and the middle and hind tibiae are without teeth, the latter longer and more uniformly dilated. The clypeal margin is strongly reflexed,



rounded, smooth and shining, and the prothorax is relatively very small, with the sides sharply angular and acutely toothed just before the base.

*Genuchus nasalis*, sp. n.

**Niger**, nitidus, nudus, angustus, vertice gibboso, dense ruguloso, fronte longitudinaliter profunde impressa, utrinque transverse carinata, antice processu lævi subquadrato, recurvato, leviter bilobato, armata, clypeo fere lævi, margine antico utrinque rotundato, vix recurvato: pronoto quam latitudinem parum breviori, utrinque fere lævi, antice et lateraliter dense ruguloso, medio longitudinaliter impresso, sulco grosso punctato, basi rotundato, lateribus antice approximatis, angulis anticis acute productis: elytris fortiter quinque-striatis, intervallis haud costatis, parce et minute punctatis, lateribus grossius et paulo crebrius punctatis: pygidio parce annulato-punctato, utrinque late impresso, corporis subtus medio parce punctato, lateribus strigoso.

Long. 10.5 mm.; lat. max. 4 mm.

UGANDA: Shores of L. Isolt or Wamala, 3800 ft. (S. A. Neave, Jan.), Kampala (C. C. Gowdey, Nov.).

This species has evidently a close resemblance to *Genuchus ruficornis*, Bourg., from the Belgian Congo, but it is a little larger and entirely black, without red antennæ, and the specimens here described have no white spots nor red extremities to the elytra. The red spots upon the posterior tibiæ are also absent. The sculpture appears to be similar to that of *G. ruficornis*, but with less strong puncturation upon the elytra, the sides of which are not densely sculptured but shining, with fairly numerous crescent-shaped non-confluent impressions. *G. nasalis* is also closely related to *G. elongatulus*, G. & P., but a little narrower in shape, the elytra, but not the prothorax, being rather more elongate. The latter is almost as long as it is wide. The quadrate, slightly bilobed process projecting forward from the back of the head distinguishes it at once from that species. The front tibia is distinctly tridentate and all the tarsi are short, but not thick or solid.

*Genuchus crassipes*, sp. n.

**Totus niger**, nudus, corpore subtus nitido, supra fere opaco, angustus, subdepressus, capite supra gibboso, rugoso, opaco, clypeo nitido, sat fortiter punctato, medio longitudinaliter carinato, margine antico bilobato, postico medio carinato: pronoto quam longitudinem paulo latiori, antice et lateraliter dense rugoso, opaco, postice fortiter punctato, spatio utrinque basali

lævi, nitido, sulcoquo mediano rugoso, opaco, lateribus medio angulatis, antice et postice fere rectis, angulis anticis obtusis, basi fere recto, scutello toto opaco, rugoso; elytrorum costis utrinque 3 inæqualibus, nitidis, punctatis, intervallis rugosis, opacis, lateribus apicibusque fortiter et crebro punctatis: pygidio gibboso, supra rugoso, opaco, subtus fortiter crebro punctato, corporis subtus medio fortiter haud crebro punctato, lateribus strigosis: pedibus brevibus, crassis, tarsis solidis, tibiis anticis obtuse tridentatis.

Long. 16 mm.; lat. max. 6 mm.

KENYA COLONY: Marakas District, Ilala, 14 miles E. of Mumias, 4500 ft. (S. A. Neave, June).

I have seen only a single female specimen.

In size, and apparently also in its general conformation, it resembles *C. brevitarsis*, Moser, but it is shining only beneath and upon a small part of its upper surface, and there are no yellow spots upon the lower surface. The head is swollen above but without tubercular process, the clypeus separated by a carina and bent at right angles to the front, its surface shining and its front margin bilobed. The pronotum is extremely densely sculptured, except in the posterior part, and has a smooth shining space at the base on each side. It is widest in the middle. Most of the dorsal part of the elytra is also very densely rugose and opaque, but the sides, the sutural costæ, and two discoidal costæ are punctured and moderately shining.

*Genuchus felix*, sp. n.

Niger, pronoti margine basali utrinque, elytrorum margine externo toto et macula juxtascutellari pygidiique lateribus sanguineo-rufis, maculisque albidis pronoti puncto utrinque ante medium, singuli elytri punctis duobus medianis fasciæque transversa anteapicali, pygidii puncto utrinque uno, decoratus, corpore supra et subtus setis parvis flavidis parce vestito: angustus, deplanatus, corpore supra et subtus dense sculpturato, clypeo fere lævi, margine reflexo, bilobato, fronte antice processu brevi recurvato, bilobato armata, postice utrinque transverse carinato: pronoto transverso, antice et lateraliter dense rugoso, basi et disci utrinque vitta angusta nitidis, fortiter punctatis, medio late sulcato, sulco crebre et grosse varioloso, lateribus rotundato-angulatis, angulis anticis paulo productis, basi leviter rotundato, scutello rugoso, margine angusto lævi: elytris dense longitudinaliter rugosis, spatio parvo juxtascutellari laxius sculpturato, subnitido, lateribus crebre et grosse punctatis: pygidio crebre et grosse punctato, utrinque depresso, corpore subtus grosse haud dense punctato, spiraculo ultimo spinoso-producto: tibiis anticis tridentatis, tarsis omnibus compactis, haud brevissimis.

Long. 11 mm.; lat. max. 4 mm.

UGANDA: Tero Forest (C. C. Gowdey, July).

There is a single female only.

Like *G. hottentottus*, this is decorated both with blood-red markings upon the upper surface and with whitish patches of powdery matter, but it differs entirely in its very closely sculptured surface and the fairly close yellowish setæ clothing it. The tarsi also are much thicker and more compact, with minute claws, and the terminal spiracle is situated at the tip of a sharp spine. There is a bilobed frontal process and also a short sharp posterior carina on each side of the head, as in *G. nasalis*.

*Stripsipher turneri*, sp. n.

Olivaceus, clypeo, elytris partim, pygidii apice vel toto, antennis et pedibus plus minusve rufo-flavidis, pronoti linea tenui laterali, nonnunquam interrupta, pygidii angulis anticis corporisque subtus lateribus plus minusve albidis, elytrorum dimidio postico, maculis 4 flavis transverse positis, interdum connexis, exceptis, nigro: ovatus, nitidus, sat robustus, capite, pronoti lateribus, pygidio corporeque subtus erecte griseo-pubescentibus, capite confluentur punctato, clypeo modice exciso, pronoto transverso, sat fortiter punctato, angulis anticis fere acutis, posticis fere rectis, basi leviter trisinuato, elytris sat fortiter parum regulariter seriato-punctatis, pygidio sat subtiliter ruguloso: (♂) tibiis anticis brevissime bidentatis: (♀) tibiis anticis latis, tridentatis, tarsis brevioribus.

Long. 12-14 mm.; lat. max. 6.5-8 mm.

PONDOLAND, CAPE PROV.: Port St. John (R. E. Turner, Sept.-Jan.).

Mr. Turner took about a dozen specimens of this species. It resembles *S. jansoni*, Pér., in form and markings, but the upper surface is much more shining, without trace of the dull bloom found in the latter. The clypeus is more deeply notched in front, the pronotum is greenish instead of black, the elytra are without distinct costæ and the third tooth of the front tibia is obsolete in the male. The elytral pattern is the same, although rather variable. The posterior half of the elytra is black, with two yellow spots on each side, which may unite into a curved transverse band. The black area curves forward towards the black-spotted shoulders and sometimes reaches them. The scutellum and the elytral suture behind it are dark green like the pronotum. The two sexes are alike in coloration and general form, but the female is a trifle broader and more convex, with shorter tarsi and antennal club.

*S. jansoni*, Pér., was described from a male and female in

the collection of Mr. O. E. Janson and the above comparison is made with the male, which I regard as the type. The female is entirely black and differs considerably in the sculpture and shape of the thorax. Although it is not impossible, there is not sufficient evidence that the two specimens belong to the same species.

In the recently published Catalogue by Schenkling, *Stripsipher* is treated as a subgenus of *Agenius*, but I prefer to separate it on account of the more prominent eyes.

*Stripsipher spectralis*, sp. n.

Flavus, capite postice, pronoti utrinque linea curvata, elytrorum sutura, marginibus, basali excepto, angulis posticis maculaque post-mediana prope suturam, pygidio, apice excepto, corpore subtus tarsisque posterioribus nigris, pronoti marginibus lateralibus, scutello, elytrorum puncto parvo juxta-laterali, pygidii angulis anticis corporisque subtus lateribus plus minusve albidis: modice elongatus, planatus, nitidus, capite, pronoto antice, pygidii apice corporeque subtus albido-pubescentis, capite dense punctato, clypei margine antico leviter innuato, pronoto fortiter, antico subrugose, punctato, quam longitudinem vix latiori, angulis anticis paulo obtusis, posticis rotundatis sed deplanatis, basi fortiter arcuato: elytris inaequaliter rugose punctatis, lineis nonnullis indistinctis longitudinalibus, apicibus lateribusque posticis dense strigosis: pygidio corporeque subtus punctato-rugosis.

Long. 10.5 mm.; lat. max. 5.5 mm.

PONDOLAND, CAPE PROV.: Port St. John (R. E. Turner, Sept.).

A single male specimen only was found. It closely resembles the male of *S. flavipennis*, G. & P., which occurs in the same locality, but is a little smaller, more roughly and densely sculptured, and therefore less shining. The pattern also is different. The clypeus is longer, its front margin less reflexed, the prothorax is smaller, less broad behind, less convex and more rugose and, instead of being uniformly coloured, is black with a yellow median stripe, dilating a little at each end, and an oval patch on each side. The elytra have a similar coloration to those of *S. flavipennis*, but the juxta-sutural black spots are not united and only a single white spot (near the middle of the outer margin) is present.

The club of the antenna is rather longer than that of the male *S. flavipennis*, in spite of the small size of the specimen.

*Celocorynus opacicauda*, sp. n.

Niger, nitidus, pronoto postice elytrisq[ue] fusco-rufis, vel totus niger: oblongus, subcylindricus, capite fortiter punctato, transversæ cornuto, clypeo quadri-lobato, lobis recurvatis, duobus anticis paulo divergentibus: pronoto fortiter punctato, antice refuso et dense punctato: elytris profunde punctato-striatis, apicibus minute et dense punctatis: pygidii lateribus subtiliter dense striolatis, medio lævi.

Long. 17-19 mm.; lat. max. 8.5-10 mm.

KENYA COLONY: Aberdare Mts., 10,000 ft. (*H. L. Andrewes*, July).

Three male specimens were taken.

The third species referred to this remarkable genus, which has the outward appearance of the Dynastidæ, this closely resembles *C. runsoricus* and *darwinianus*, of Kolbe, and especially the former, but it may be readily distinguished by the pygidium, which, instead of being shining and strongly punctured, is finely and closely striolate except in its median part. In other respects *C. opacicauda* differs only very slightly from *C. runsoricus*. The frontal horn is a little more elevated, the four clypeal lobes are a little more produced and the anterior ones slightly divergent, the prosternum is rather more strongly punctured, the elytral striæ are a little deeper and the apical margins more finely and closely punctured.

LXXXI.—*A new Genus of Tetriginæ from Tahiti*  
(*Orthoptera*, *Acrididæ*). By B. P. UVAROV.

HYDROTETRIX, gen. nov.

PROBABLY allied to *Mazarredia*, Bol., but more robust, with abbreviated and tectiform pronotum and without elytra or wings.

Antennæ filiform; their base at the level of the lower margins of the eyes. Head somewhat projecting above pronotum; frontal ridge in profile distinctly rounded-prominent between antennæ; fastigium of vertex narrower than an eye, truncate in front, bi-impressed, with the lateral margins strongly raised, sublobate. Pronotum not covering the whole of abdomen, decidedly tectiform, truncate in front; median keel compressed, sharp, in profile well raised and convex in the anterior half, rather suddenly lowered,

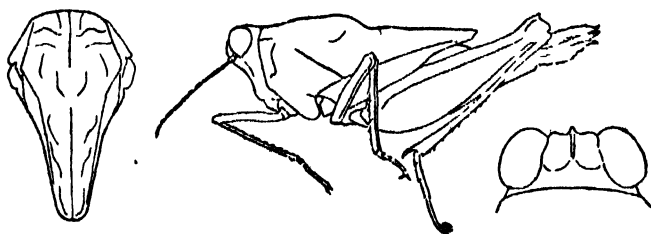
but not depressed, behind the middle; posterior process broadly obtusangulate behind; lateral lobes oblique, with the hind angle laminate, directed obliquely sideways, rounded apically. No clytra or wings. Anterior femora little compressed, with straight margins; middle femora distinctly compressed, with the lower margins wavy. Hind tibiæ very slightly expanded towards the apices. Hind tarsi compressed, with the first joint somewhat longer than the third.

Genotype: *Hydrotetrix cheesmanæ*, sp. n.

*Hydrotetrix cheesmanæ*, sp. n. (Fig. 1.)

♀.—Face shiny, sparsely and very minutely granulose. Fastigium trapezoidal, not deeply impressed; vertex behind without transverse ridges. Pronotum tectiform, between the shoulders somewhat inflated, just behind them broadly

Fig. 1.



*Hydrotetrix cheesmanæ*, gen. et sp. n.

and shallowly bi-impressed and the median carina lowered; the inflated portion with some short, feeble, and irregular longitudinal rugosities; hind process with the surface undulated, shiny and with scattered granules like the whole of pronotum, with a pair of very faintly indicated and irregular supplementary ridges. Lateral carinæ distinct near the front margin and at the shoulders. Lateral lobes with the surface strongly uneven, with two scarcely perceptible short supplementary carinulæ in prozona. Front femora scarcely compressed. Hind tarsi more than half the length of hind tibiæ.

Dark brown, shiny, somewhat blackish on the pronotum, which is paler laterally, especially on the lateral expansions of the posterior process. Hind tibiæ and tarsi pale testaceous; apices of tarsal joint a little darker.

Total length 12 mm.; pronotum 8; hind femur 6·5.

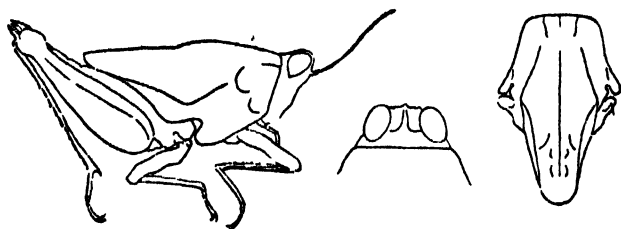
A single female taken swimming at the lake Vaihira, Tahiti, 18. vii. 1925, by Miss E. Cheesman.

*Hydrotetrix aspera*, sp. n. (Fig. 2.)

♂.—Smaller and more roughly sculptured than the genotype.

Face very finely, but densely granulose. Vertex deeply bi-impressed, with a distinct transverse ridge behind. Pronotum strongly tectiform, not inflated between the shoulders and scarcely impressed behind them; the whole surface very densely granulose, with some larger tubercles, especially on the hind process, and with a pair of very short, but sharp, submedian ridges between the shoulders, and without supplementary ridges on the process. Lateral lobes each with two short and sharp supplementary ridges in prozona. Front femora distinctly compressed. Hind tarsi shorter than half the length of hind tibiæ.

Fig. 2.



*Hydrotetrix aspera*, sp. n.

Dark brown, dull; pronotum with an indefinite angular transverse dark fascia behind the shoulders. Hind tibiæ blackish, with the base testaceous; hind tarsi testaceous, the apices of their joints blackish.

Total length 10 mm.; pronotum 6; hind femur 5.

The type is from near Papeete, 2000', Tahiti, 7. v. 1925; a female paratype from near Papeete, 3000', Tahiti, 30. iv. 1925; a larva from near Papeete, iv-v. 1925 (Miss E. Cheesman); all taken swimming, except the paratype female, reddish-brown above, which was taken on reddish soil.

The types of the two new species described in this paper are deposited in the British Museum, together with other material brought home by the 'St. George' Expedition. I am obliged to Miss E. Cheesman for illustrating the paper.

LXXXII.—*Descriptions and Records of Bees.*—CXI.

By T. D. A. COCKERELL, University of Colorado.

*Acanthopus splendidus urichi*, subsp. n.

♂.—Larger and more robust than the continental form. Wings a little longer, with strong blue-purple tints (rosy purple in the typical form). Abdomen broader, less highly polished, bluish green.

Trinidad, B.W.I. (*F. W. Urich*).

I have true *A. splendidus* (Fab.) from French Guiana; according to Schrottky it extends to Bahia and Manaos in Brazil. A male from the Amazons, from F. Smith's collection, is typical in form, size, and colour of wings, but the abdomen is magnificent blue. In Schrottky's key it runs to *A. excellens*, Sky., but it is not that species.

*Exærete dentata* (Linné).

Trinidad, B.W.I. (*Urich*).

New to Trinidad. Hart (1896) recorded *E. nitida*, Perty, from Trinidad.

*Exærete smaragdina* (Guérin).

Trinidad, B.W.I. (*Urich*).

New to Trinidad. The specimens include the ordinary form with green abdomen, and a variety (var. *cyanescens*, nov.) with the hind margins of the segments broadly purple-blue. The variety is in both sexes.

*Euglossa (Glossura) piliventris* (Guérin).

Trinidad, B.W.I. (*Urich*).

New to Trinidad. *E. cordata* (L.) is also common in Trinidad and was long ago recorded by Friese.

*Xylocopa frontalis cæruleomicans*, Enderlein.

In 1912 I recorded *X. frontalis morio* from Independencia, Brazil. This was the form with the wings shining purple-blue, separated as a distinct variety by Enderlein in 1913. *X. frontalis* is not uniform in its wide range, and it is possible to distinguish a number of local races, as follows:—

*Xylocopa frontalis callichlora* (Cockerell, 1911).

\*Described from Peru.

Enderlein (1918) described it as *viridimicans*.

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*Xylocopa frontalis frontalis* (Olivier).

Described from Cayenne.

Female abdomen with dark red bands (black in all the other varieties); wings dark, suffused with lilac. Goes south to Paraguay.

*Xylocopa frontalis nitens* (Lepelletier).

Described from Cayenne.

Wings of female black, with violet reflections, and the lower border suffused with coppery. I have used this name in place of the preoccupied *morio* (Fabricius), but have not seen any specimens with the wings as Lepelletier describes.

*Xylocopa frontalis fabricii*, subsp. n.

♀.—Wings black, shining, violaceous, tending to greenish, but with no coppery or brassy colour; form more slender than in *cæruleomicans* (width of abdomen 12 mm.); third abdominal segment at sides posteriorly with a transverse densely rugoso-punctate band; succeeding segments with similar rugose areas; fourth segment with scattered strong punctures.

Type from French Guiana ("Guyane, Maroni"). Also from Surinam and Para, Brazil (*W. M. Mann*).

This I take to be the genuine *morio*, but that name is preoccupied by Swederus.

*Xylocopa frontalis roseata*, subsp. n.

♀.—Wings brown, subtranslucent, shining pale greenish-golden, the outer margin broadly pale rosy. Abdomen 12.5 mm. broad; sculpture similar to that of the last, but third segment more strongly punctured at sides, and the rugoso-punctate areas much less compact. The clypeus has very coarse punctures and no distinct smooth line. Two from Ecuador (*Button*), sent by Mr. Ulrich. The precise locality is not known. This may possibly be the female of *X. frontalis quadrimaculata*, Meunier, based on the male from Quito. The wings are much more rosy and less green than in *callichlora*, which occurs on the coast of Ecuador.

*Xylocopa frontalis trinitatis*, subsp. n.

♀.—Wings black, coloured as in the mainland *fabricii*, but duller, less shining. Abdomen 13 mm. wide; third segment without rugoso-punctate patches at sides, fourth

with weak patches; punctures on fourth segment sparse. Three from Trinidad, B.W.I. (*F. W. Urich*); also males, with the usual characters of *X. frontalis*.

*Xylocopa appendiculata*, Smith.

♀.—Suifu, Szechuen, China, Sept. (*D. C. Graham*); Kiating, China, 1500 ft. (*Graham*). Both U.S. National Museum. The Japanese *Xylocopa* is hardly to be separated; it must stand as *X. appendiculata circumvolans* (Smith).

*Xylocopa darwini*, sp. n.

♀.—Length 21–23 mm., anterior wing 17·5 to 18.

Black, with long slender wings, which are dark fuliginous, with obscure green tints within the cells, very faintly violaceous beyond; pubescence black; middle tooth of labrum similar to lateral ones, and fully as long, but slightly larger; tip of scape and second antennal joint red; third joint about as long as 5 + 6; upper lobe of laminate process on outer side of hind tibiae broadly rounded, much less produced than lower. This is an extremely puzzling form, related to *X. transitoria*, Pérez, and *X. carbonaria*, Smith, for which it appears to have been taken. There is a specimen from the same locality in the British Museum under *carbonaria*, which it exactly resembles superficially. However, *X. carbonaria* (which I have from Mexico, apparently correctly determined) has the scutellum ordinary, whereas *X. darwini* has it angulate in profile, the apical part vertical or subvertical. This last character should place it in *X. transitoria*, which, however, is described as having the median tooth of labrum small and globulose. The species from Guayaquil, which I have hitherto identified as *X. transitoria*, is certainly different, having the labrum as described by Pérez, the wings shorter and quite differently coloured, the abdomen more strongly and less closely punctured, and the upper lobe of process on hind tibiae pointed. In appearance *X. darwini* is exactly like *X. ordinaria*, Smith (*La Rioja*, Argentina, *Giacomelli*), but it differs by the more evidently truncate scutellum, the much less violaceous wings, and the much finer punctures of abdomen. Compared with *X. brasiliannorum* (L.), from Paita, Peru, *X. darwini* differs at once by the more elongate and differently coloured wings, the structure of scutellum and labrum, and the complete smooth median band on clypeus.

2 ♀.—Chatham Island, Galapagos (U.S. National Museum).

I examined Smith's type of *X. carbonaria* (Tapajos, Brazil) and *X. ordinaria* in the British Museum, and noted: *ordinaria* is large, with very dark wings; *carbonaria* also has dark wings, but is much smaller. The wings are shining purple and blue, the same colour in both species. The anterior wing is 21 mm. long in *ordinaria*, 17 mm. in *carbonaria*. The middle tubercle of labrum in *carbonaria* is nearly like the lateral ones, in *ordinaria* it is shorter and more elevated. Meade-Waldo placed both species in the *X. brasiliatorum* aggregate. *X. transitoria* is said by Pérez to come from Argentina and Merida, Venezuela. It is almost certain that it is composite; Argentina, being first cited, may be designated the type-locality.

I looked up the Fabrician specimen (♂) of *brasiliatorum* in the Banks collection at the British Museum. It has anterior wing 18 mm., width of head 6 mm., width of thorax to outer margins of tegulæ 9.5 mm.; abdomen quite long, hind margins of segments broadly dusky. This is very like *X. augusti*, Lep., but too small. It appears to be *brasiliatorum* as generally understood.

In the old Hope collection at Oxford is a specimen of ♀ *X. tranquebarica* (Fab.) labelled *brasiliatorum* and said (of course, erroneously) to be from E. Brazil. Another male "*brasiliatorum*" at Oxford is *X. frontalis*, Oliv.; the label is an old one on blue paper. The specimen is peculiar for having on each side a branch from the second intercubitus extending a short distance into the cubital cell.

*Mesotrichia tambelanensis*, sp. n.

♀.—Length about 25 mm., anterior wing 21, width of head 7.4.

Black, robust, thorax above and mesopleura densely covered with bright fox-red hair, first abdominal tergite thinly covered with the same; clypeus strongly punctured, with an impunctate median line; flagellum, except basally, dusky ferruginous beneath; hair of face thin, dull ochraceous and black mixed, the general effect dark; cheeks with dull pale yellowish hair; tegulæ black. Wings dark fuliginous, shining violaceous. Legs with black hair. Abdomen shining, broad, well punctured, apex with black hair.

3♀.—Big Tambelan Island, about 100 miles west of Borneo (*W. L. Abbott*, U.S. National Museum).

Very closely resembles the Philippine Ia. *M. cuernosensis*, Ckll., but the wings are violaceous throughout, the first abdominal segment has red hair, the second is more coarsely

and less closely punctured, and there is much more red hair at sides of thorax.

*Mesotrichia sinensis* (Smith).

Shin Kai Si, Mt. Omei, 4400 ft., Szechuen, China, Sept. (D. C. Graham); Suifu, Szechuen, October (Graham). All in U.S. National Museum.

*Megachile lagopoda seitziana*, Cockerell, 1925.

Mr. J. D. Alfken writes me that the above name applies to an Algerian subspecies which he described in 1914. His account merely refers to the darker hair, and he ends by saying, "This melanic form may be called *M. nigricans*." It appears, however, that *nigricans* is not available, Cameron having described a *Lithurgus* as *Megachile nigricans* in 1898.

*Anthidium atricaudum*, Cockerell, 1926.

Since this Peruvian species was described, and while it was awaiting publication, Friese published the same insect as *A. piliventre*. This would be the valid name, were it not that Friese himself published an African *A. piliventre* in 1918.

*Osmia cærulescens dutti* (Cockerell).

*Osmia dutti*, Ckll., 1922, differs (♂) from *O. cærulescens* by being smaller, with white hair on head and thorax, the general aspect being quite distinctive. Mr. C. Dover referred it to *O. cærulescens* on the ground that the description showed no differences of specific importance. I thought he was mistaken, but at my request Miss Grace Sandhouse examined the genitalia of a cotype *C. dutti*, and found them exactly as in *cærulescens*. It is thus evident that the two names refer to one species, but I think *O. dutti* (Punjab, 7500 ft.) may stand as a race. It may be, however, that the older name *kashmirensis*, Nurse, should be used for it.

*Paracolletes irroratus* (Smith).

Smith's *Lamprocolletes irroratus* and *Dasycolletes humerosus* come from nearly the same locality, and are I am sure one species. The pyriform patch of moss-like hair at sides of thorax anteriorly is red in *irrorata*, yellow in *humerosus*, but in specimens before me it varies from rich orange (Lilydale District, F. P. Spry) to lemon-yellow (Warburton District,

Victoria, *F. P. Spry*). The original type of *humerosus* has the first recurrent nervure joining the second cubital cell distinctly before its middle, but usually it goes almost exactly to the middle. These are all females, but the undescribed male comes from the Warburton district (*Spry*; Melbourne Museum). It is similar but more slender, the face densely covered with silky brownish-white hair; antennæ long, entirely dark; tubercles fringed with white hair.

*Hylæus morosus* (Smith).

♀.—Brighton, Victoria (Melbourne Museum).

I find that the flagellum of female *H. sculptifrons* varies to obscure reddish beneath, and it now seems evident that the two supposed species are races of one, that later described to stand as *H. morosus sculptifrons* (Cockerell). A male having the characters of *sculptifrons* comes from Gippsland (Melbourne Museum).

*Hylæus pergibbosus*, sp. n.

♂.—Closely related to *H. dromedarius* (Ckll.) in all respects, differing thus:—larger (length about 9 mm.), scape black in middle, flagellum blackened above, tubercles bright yellow; tegulæ dark reddish with a small yellow spot; yellow on scutellum bulging anteriorly; anterior femora reddish in front, black behind, yellow apically, the yellow merging into the red in front, but sharply defined behind; middle femora very stout, similarly marked, but there is no yellow behind; hind femora mainly black, but red at apex, and at base above, the trochanters also red; anterior tibiæ yellow, with a dark reddish mark; middle tibiæ dark on outer side and partly posteriorly, otherwise light yellow, slightly suffused with reddish; hind tibiæ black, reddish at base; basitarsi cream-colour; small joints of anterior tarsi pale red, of the others mainly dark brown; hind margin of first abdominal segment black; nervures dark fuscous, stigma dark reddish.

Also allied to *H. certus* (Ckll.), differing by the first two abdominal segments being red with black hind margins. The three species, with *H. elongatus* (Sm.) and *H. quadratus* (Sm.), form a distinct group of the genus.

Kewell, Australia, Nov. 1885 (Melbourne Museum).

*Hylæus nubilosus* (Smith).

Smith described the female. A male from near Melbourne (Melbourne Museum) closely resembles the Queensland

form *H. nubilosus aureomaculatus* (Ckll.), but has the anterior wings dusky at apex, the first recurrent nervure ending before the first intercubitus, the upper border of prothorax all black, and the supraclypeal mark represented by a dot. The character of the venation, with relatively short second cubital cell, is not normal for the species, but it seems improbable that a distinct species is indicated.

*Hylæus alcyoneus robustus*, subsp. n.

Considerably larger, 12–13 mm. long, robust, third ventral abdominal segments of male with a large dentiform process on each side.

National Park, Australia (*T. McC.*, 10. 12. 09). Also one labelled New South Wales.

The type is a male.

The typical *H. alcyoneus*, Erichs. (*vidua*, Smith), is before me from Mordialloc, Victoria. The male is 10 mm. long, and the abdomen is not dentate beneath\*.

*Hylæus spryi*, sp. n.

♂.—Like male *H. nubilosus*, but larger (length about 6.5 mm.), robust; face-marks distinctly yellowish, a small supraclypeal mark; scape robust, closely punctured, entirely black; postscutellum black with a minute yellow dot. Other characters are: a long black mark at each side of clypeus; labrum dark; flagellum ferruginous beneath; scutellum shorter than in *H. nubilosus*; upper part of marginal cell and region beyond strongly suffused with fuliginous; second cubital cell large, receiving recurrent nervures about equally distant from base and apex; polished spaces on front above antennæ very large.

“Belgrave, 26. 12. 06” (*F. P. Spry*; Melbourne Museum).

In my key this runs nearest to *H. frederici*, Ckll., which is very different. I had to consider the possibility that this was the true male of *H. nubilosus*, instead of the form described above. After close examination, I do not believe that this can be the case, but the whole matter should be reinvestigated by students in the field. In neither case does the venation agree with Smith's type female, but it seems probable that it is variable within the species.

\* *Prosopis chalybæa*, Friese, is based on a female from New Zealand and a male from Australia. They are presumably different species, and the name should be restricted to the New Zealand insect. The male, so far as can be ascertained from the description, appears to be *H. alcyoneus*.

*Hylæus bituberculatus* (Smith).

♂.—Dandenong Ranges, Victoria, January (*Spry*; Melbourne Museum).

*Hylæus bituberculatus tasmanicus*, subsp. n.

The Tasmanian form (male, Launceston, 7.11.15, *F. M. Littler*) is smaller, with the lateral face-marks not globose in outline above, and the pointed abdominal processes very much smaller. It appears to represent a distinct subspecies. The wings are dusky.

*Hylæus amicola* (Smith).

♀.—Lilydale district, 2. 14 (*Spry*; Melbourne Museum).

*Palæorhiza reginarum* (Cockerell).

*Prosopis cærulescens*, Friese, 1924, is a synonym.

*Palæorhiza purpureocincta*, sp. n.

♂.—Length about 8.5 mm.; expanse 15 mm.

Head and thorax greenish blue, flushed with purple on sides of thorax, on face and cheeks; face much longer than broad, with three white bands; one begins very narrowly at middle ocellus, gradually widening to lower margin of supraclypeal area, thence continuing as a long-triangular area on clypeus, at top narrower than supraclypeal mark, but laterally separated from lateral bands by only a narrow stripe; lateral bands extending the whole way up face and front, tapering at either end; labrum and mandibles dark; malar space large; tongue sharply pointed; posterior orbits with a white stripe; scape long and slender, white in front; upper border of prothorax, tubercles, large patch behind, broad oblique band at each side of scutellum, and transverse band (emarginate anteriorly) on postscutellum, all white; mesothorax dullish, strongly and densely punctured; area of metathorax large, shining; pleura densely punctured; tegulae with a white spot; wings very faintly dusky, stigma and nervures dark brown; second cubital cell very broad, receiving recurrent nervures about equally distant from base and apex. Legs strongly metallic, shining purple, anterior tibiae in front, and other tibiae broadly at base, white; middle femora somewhat reddish. Abdomen shining, weakly and not densely punctured, brilliant greenish blue, the hind margins of the segments rosy-purple; no hair-bands, but

thin white pubescence at sides of segments; apex bidentate; ventral segments 4 to 6 with black fringes.

Endeavour River, Queensland (Melbourne Museum; presented by F. P. Spry).

Related to *P. parallela disrupta*, Ckll., but easily separated by the colour of the abdomen, the marks on scutellum and postscutellum white (yellow in *disrupta*), and those on scutellum much more widely separated, and the first recurrent nervure much less remote from first intercubitus.

*Euryglossa nigrocærulea*, Cockerell.

Fern Tree Gully, Victoria (Spry; Melbourne Museum).

*Andronicus cylindricus*, Cresson.

Mr. Charles Hicks has bred this species at Boulder, Colorado, and it turns out that *Hoplitis monardæ*, Ckll., is its female.

# LXXXIII.—*New Reptiles and a new Frog from Queensland.* By H. W. PARKER, B.A.

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AMONG the reptiles and batrachians collected by Capt. G. H. Wilkins in Queensland and Northern Territory, Australia, for the British Museum are representatives of four species which do not appear to have been described previously. All the specimens mentioned below are in the British Museum.

## LACERTILIA.

### 1. *Diplodactylus platyurus*, sp. n.

Type-specimen a ♂, No. 1924.3.3.8, from Torrens Creek, N. Queensland (Lat. 21° 25' S., Long. 145° 14' E.).

Head high, convex; snout pointed, conical, considerably longer than the distance between the eye and the posterior border of the ear-opening, once and a half the diameter of the orbit; ear-opening small, vertically oval. Rostrum large, twice as broad as high, six-sided, without median cleft; nostril pierced between a well-developed crescentic anterior and five or six small posterior nasals, not touching the rostral or upper labials; anterior nasal separated from its fellow on the upper surface of the snout by two granules;



upper labials scarcely distinguishable from the granules on the sides of the snout, 15 to 17 to below the centre of the eye; lower labials similar; mental almost as large as the rostral; no definite chin-shields, but a few scales round the mental are slightly enlarged. Body covered above with uniform juxtaposed granules, which are slightly larger on the mid-dorsal region than on the flanks; ventral scales transversely oval, juxtaposed, about as large as the laterals; gular scales minute, circular. Limbs slender, slightly overlapping when adpressed; covered with uniform granules, which, on the forearm, leg, manus, and pes are sub-imbricate. Digits scarcely dilated at the apex, which has two small oval plates inferiorly; basal portion of the digits with rounded tubercles beneath. Tail (not reproduced) short, oval, depressed; as wide as the body, convex above, flat below; covered above with transverse rows of tubercles, which, in the centre and posteriorly, are much enlarged (about four times as large as the dorsal granules), hexagonal, and with a small central tubercle; covered below with flat, oval, imbricating scales. A cluster of small spines is present on each side of the thickened base of the tail.

*Colour in spirit.*—Pinkish white above and below; above, irregularly dusted with dark brown which is more concentrated on the flanks and leaves an indistinct, irregular, zig-zag, clear dorsal stripe. Flanks with small, indefinite, circular, light spots. Beneath immaculate.

	mm.
Length .....	60
Snout to vent .....	44
Snout to ear-opening .....	10
Width of head .....	9
Fore limb .....	13
Hind limb .....	16
Tail width .....	11

Two paratypes, both males from the type-locality, agree with the type in all essentials. In one the anterior nasals are separated by a single small shield. In colour, one shows the dark dusting more intensified than in the type and with a better defined dorsal stripe; in the other this stripe can scarcely be discerned.

This species appears to be closely allied to *D. hilli*, Longman, and *D. conspiciellatus*, Lucas & Frost; from the former it may be distinguished by its longer snout and broader rostral, from the latter by its broader rostral, large upper caudal scales, and the coloration.

2. *Lygosoma (Rhodona) wilkinsi*, sp. n.

Type-specimen No. 1924.3.3.55, from Torrens Creek, N. Queensland (Lat.  $21^{\circ} 25' S.$ , Long.  $145^{\circ} 14' E.$ ).

Body very elongate, no trace of fore-limb; hind limb didactyl. Snout subconical, projecting. Eye small, the lower eyelid with a transparent disc. Rostral large, swollen, without sharp lateral edge; nasals large, swollen, in contact behind the rostral; fronto-nasals united into a single shield which is broadly in contact with the frontal; præfrontals

Fig. 1.

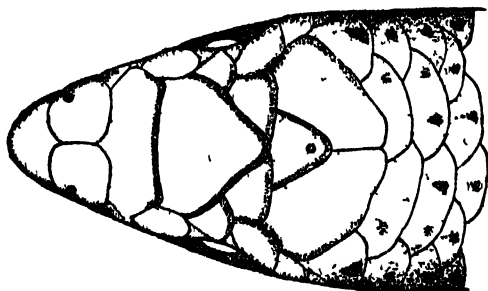
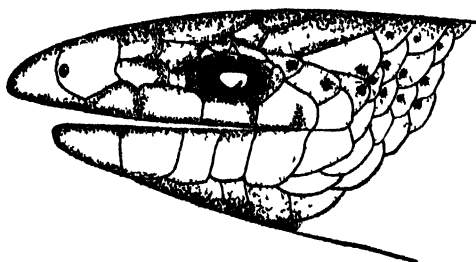


Fig. 2.



*Lygosoma (Rhodona) wilkinsi*, sp. n.

absent (or small and in the position of an anterior supra-ocular, according to the point of view); frontal large, slightly broader than long, much broader than the supra-ocular region; fronto-parietals and interparietal distinct; parietals in contact behind the interparietal and followed by two pairs of enlarged nuchals. Five upper labials, the first swollen, the third entering the orbit; five lower labials, the first and the mental swollen. Ear-opening minute. Eighteen

small scales round the body, two enlarged pre-anals. Hind limb shorter than the distance between the tip of the snout and the ear-opening; outer toe more than twice as long as the inner.

*Colour in spirit.*—Silver grey above, whitish beneath; dorsal and lateral scales each with a brown dot, more pronounced on the sides and tail where they produce the effect of narrow longitudinal lines; head-shields indefinitely edged with brown, belly and throat immaculate; lower surface of tail with brown dots forming rather irregular longitudinal lines.

	mm.
Total length (tail partly regenerated) . . . .	135
Snout to vent. . . . .	74
Hind limb . . . . .	5

Two paratypes, an adult and a half-grown from the type-locality, show slight variations. In the adult the number of scale-rows at the mid-body is 20; in both the ground-colour has lost its original silveriness and is buffy, whilst the dark spots are more pronounced over the whole body and there are traces of a dark streak from the nostril through the eye to the side of the body.

This species most nearly approaches *Lygosoma (Rhodona) bipes* (Fischer) in the degree of reduction of the limbs, but is readily distinguishable from it by the distinct fronto-parietals and interparietal, the lack of a sharp lateral edge on the rostral, the much shorter hind limbs, and the coloration.

## OPHIDIA.

### 3. *Demansia guttata*, sp. n.

Type-specimen a ♀, No. 1926.2.25.107, from Winton. Queensland (Lat. 22° 19' S., Long. 143° 4' E.).

Eye moderate, its diameter half the length of the snout. Rostral a little broader than deep, the portion visible from above about half as long as its distance from the frontal; internasals broader than long, three-quarters the length of the præfrontals; frontal once and a half as long as broad, broader than the supraocular, shorter than its distance from the end of the snout and than the parietals; nasal entire, just in contact with the single præfrontal which is but very slightly hollowed out; two postoculars; temporals 1 + 2;

six upper labials, the third and fourth entering the orbit, the sixth largest; three lower labials in contact with the anterior chin-shields, which are longer than the posterior; the first pair of lower labials very large, as long as the anterior chin-shields; the posterior chin-shields separated by scales. Scales smooth, without apical pits, in 21 rows round the middle of the body (formula 23.21.15); ventrals 207, anal divided; subcaudals 56, all paired.

*Colour in spirit*.—Above pale brown, some of the scales with a dark brown outer edge; eleven large, indistinctly-margined dark blotches between nape and vent, each about as large as a light interspace; tail with two small indefinite dark blotches. Under surfaces white except for a patch, about 60 ventrals long, in the middle of the belly, which is olive.

Total length 740 mm. Tail 115 mm.

The paratype, a female from the type-locality, differs from the type in some details. The nasal is separated from the præocular, the frontal is as long as its distance from the end of the snout, and the dorsal dark spots are not distinct. Ventrals 207; subcaudals 53.

This species differs from all the described species of *Demansia* in having 21 scale-rows round the middle of the body and in the very slightly hollowed out præoculars; it must, however, be referred to this genus as it has 7 or 8 posterior maxillary teeth, a round pupil, and paired subcaudals. It is, apparently, most closely related to *D. textilis* (Dum & Bibr.), from which it may be distinguished by the different proportions of the head-shields (particularly the relative breadths of the frontal and supraocular) as well as the dorsal lepidosis.

## BATRACHIA.

### 4. *Pseudophryne fimbrianus*, sp. n.

Type-specimen a ♀, No. 1923.11.12.3, from the St. George district, Queensland (Lat. 28° 14' S., Long. 148° 35' E.).

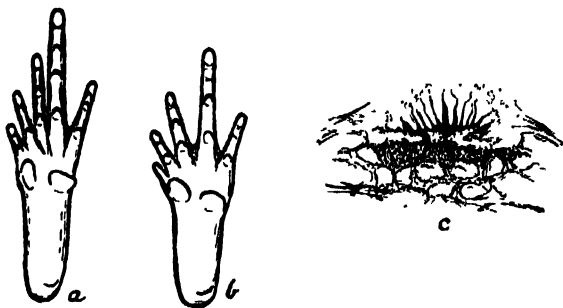
Snout rounded, slightly longer than the greatest diameter of the eye; nostril nearer the end of the snout than the eye; interorbital space broader than the upper eyelid. Fingers moderate, the first shorter than the second; toes moderate, with a rudiment of web and a slight fringe; two large metatarsal tubercles; no tarsal tubercle; when the hind limb is

addressed the tip of the fourth toe reaches well in advance of the snout. Skin above slightly warty, with a pair of distinct parotoid glands; beneath granulate; the flap of skin covering the cloacal opening is distinctly fimbriated and the skin of the hinder side of the thighs thrown into a rather indefinite fold which encloses a shallow oval depression below the cloaca (fig. 3, c).

*Colour in spirit.*—Uniform blackish brown above; whitish, slightly dusted with darker, beneath.

This species differs from all the described species of the genus in the peculiar fimbriated cloacal flap. It is, apparently, most closely related to *P. guentheri*, Bouleng., and *P. mjobergi*, Anderss.; from the former it may be distinguished by its relatively longer fingers and toes, and from the latter by the absence of any trace of tarsal tubercle.

Fig. 3.



a. Pes of *Pseudophryne fimbriatus*, sp. n.;  
b. Ditto of *P. guentheri*, Bouleng. c. Cloacal region of *P. fimbriatus*.

A second *Pseudophryne* (also a mature ♀) collected on Groote Eylandt, Northern Territory, appears to be referable to this species. The specimen is, unfortunately, hard and shrivelled, so that the identification cannot be regarded as certain. The fimbriated cloacal flap, general bodily proportions and colour are the same as in the type; the webbing between the toes, however, has the form of small tubercles, and the fold of skin below the vent is much more strongly developed, extending laterally and dorsally on each side beyond the cloacal flap. If this provisional identification is correct, the species must have a very considerable range through North Australia.

LXXXIV.—*Preliminary Note on a new Species of Tick of the Genus Dermacentor from Mount Everest.* By STANLEY HIRST.

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*Dermacentor everestianus*, sp. n.

♂.—*Body* rather long and narrow, the anterior end being narrower than the rest. Darker patches of coloration on *dorsum* mostly quite narrow and elongated. Punctations on *dorsum* numerous and very fine; there is also a short longitudinal line of slightly larger punctations at the anterior end of the lateral groove; this groove does not extend to the posterior end of the body nor include the festoons. It is difficult to see the finer details of the structure of the *spiracle* in our unique specimen, but the goblets seem to be small and numerous; its dorso-lateral prolongation long and narrow. Dorsal spur on second segment of *palp* obsolete. Basal segment of *palp* ventrally without any distinct process. Cornua of *capitulum* apparently well-developed. (*Note*.—One *palp* and also half of the *capitulum* are malformed, being poorly developed.) *Coxa* of *fourth leg* rather long and narrow, being furnished with a single spur. Femur, patella, and tibia of posterior legs with very distinct denticles.

*Length* of body 4·15 mm.; its width 2·5 mm.

*Hab.* Tinki Dzong, Tibet; alt. 15,000 feet, 2. v. 1924 (*Major R. W. G. Hingston*). Mt. Everest Expedition.

A longer description with figures will be published in a paper on mites and ticks now in preparation.

LXXXV.—*A new Genus of Bythoscopidæ (Jassoidea, Homoptera).* By W. E. CHINA.

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IN 1851 Walker\* described a new species of "*Paropia*" from an unknown locality under the name *Paropia guttifera*. This species has remained unknown for three-quarters of a

\* List Homopt. Ins. in Brit. Mus. iii. p. 645 (1851).

century. Distant, in his arrangement of the British Museum Collection, realized its true relationships and placed the single type-specimen in the Bythoscopidæ. The Imperial Bureau of Entomology has now received thirteen specimens from Mr. E. Hargreaves, Government Entomologist in Sierra Leone. A new genus must be erected to hold the species.

*ROTIFUNKIA*, gen. nov.

Head including the eyes slightly broader than the pronotum at the base; as seen in dorsal view evenly rounded in front, the posterior margin very slightly reflexed and overhanging the pronotum; ocelli placed closer to the eyes than to one another; antennal scrobes moderately shallow. Pronotum smooth and shining, short, about twice and a half wider than long in the middle. Tegmina short and broad especially apically, the appendix being well developed; moderately opaque except the third and fourth apical cells and the appendix; first apical cell very broad and poorly defined from the small first subapical cell. Wings with the typical Bythoscopid venation. Front tibiæ distinctly curved; the hind tibiæ strongly flattened, the edges obscurely defined and with relatively few spines.

Genotype: *Paropia guttifera*, Walker.

Allied to *Agallia*, but without sculpturing of head and pronotum, legs flattened, front tibiæ curved, hind tibiæ with very few spines arranged along the more or less obsolete edges and a very broad apically diverging first apical cell.

*Rotifunkia guttifera*, Walker.

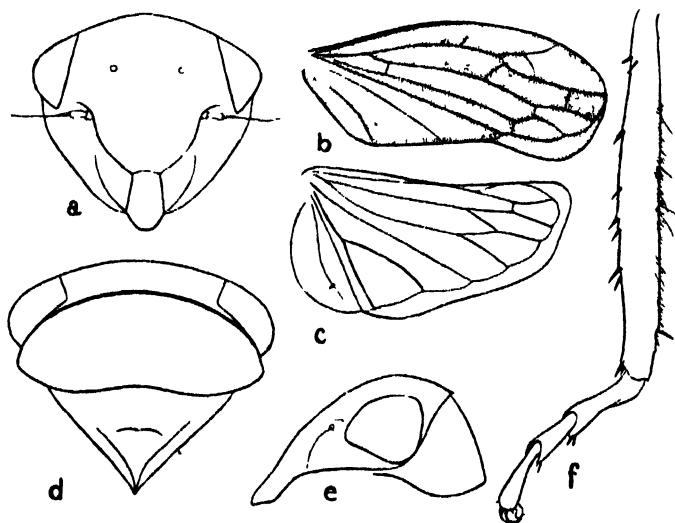
*Paropia guttifera*, Walk. List Homopt. Ins. iii. p. 845 (1851).

*Redescription* \* :—

♂ ♀. Shining black, glabrous, very finely shagreened, the rostrum (except apex), the outer margins of the genæ, a small median spot (forming a line posteriorly) on the frons just below the line of the ocelli, the posterior margins of the head and pronotum (obscurely and very narrowly), the posterior margins of the abdominal sclerites especially towards the sides, a triangular spot on the basal half of the

\* Walker's description is from a teneral and badly preserved specimen.

last ventrite in the ♀ and the bases of the genital valves in the ♂, all pale yellowish white. Tegmina shining black shading to dark brown on the less opaque apical area, with two pale yellowish-white longitudinal stripes in the clavus, usually coalescing (the anterior stripe running between the outer claval vein and the claval suture, the posterior stripe running along the vein but slightly obliquely to it), a very small spot at the apex of the clavus and a round somewhat



*Rotifunkia guttifer*, Walker.

a, face; b, tegmen; c, wing; d, dorsal view of head, pronotum, and scutellum; e, lateral view of head and pronotum; f, hind tibia and tarsus.

hyaline spot on the costal margin towards the apex of the tegmen white. Wings greyish hyaline with dark brown veins. Spines on the legs light brown. Last ventrite in ♀ medianly carinate and tectiform, its posterior margin truncate with a very slight median indentation.

Length 3.5 mm.; breadth across eyes 1.4 mm.

W. Africa, Sierra Leone; twelve specimens from Rotifunk, 6. vii. 1925, and one specimen from Waterloo, 23. viii. 1925 (*E. Hargreaves*).



LXXXVI. — *Two new Species of Chirocharis, Kolbe*  
(Coleoptera, Fam. Tenebrionidæ). By K. G. BLAIR,  
B.Sc., F.E.S.

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*Chirocharis (Hemipristis) curvipes*, sp. n.

Black, shining, subparallel. Head rugose, with a wide depression between the eyes; on the posterior rim of this depression are two tubercles placed together near the middle line, at a level a little behind the eyes; clypeus bituberculate, asymmetrical, the left tubercle much larger than the right; sides of clypeus convergent, in line with the genæ; a further strong tubercle within, and a little in front of, the eye on each side. The area enclosed by these tubercles, frontal, clypeal, and ocular, forms an ellipse distinctly longer than wide, and is rather coarsely scabrous. Antennæ stout, joints 1 to 6 smooth and polished, 7 to 10 with minute asperities and sparsely hairy. Mentum hairy, transversely cordate, the ventral genæ with two large teeth on each side, the external a little larger than the internal and coarsely sculptured. Thorax subquadrate, the sides nearly straight, slightly convergent towards base and apex, both of which are emarginate. Elytra widest behind middle, smooth, striæ marked by lines of fine punctures, somewhat irregular in the female, intervals almost flat, minutely punctulate. Anterior tibiæ strongly bent, quadridigitate, inner side with a deep emargination before base, the upper face basal to the emargination being coarsely punctate, beyond it smooth; intermediate tibiæ sparsely and finely punctate on outer face.

♂ with small nearly round velvet-like spot on each side of second abdominal segment.

Length 50 mm.

*Hab.* Tanganyika Territory, Kinole; April 1925 (*A. H. Ritchie*, per the Imperial Bureau of Entomology).

In size and general appearance this new species most nearly resembles *H. muelleri*, Kraatz, in which, however, the head is less elongate, with the intertubercular area about twice as wide as long, the sides of the clypeus subparallel, forming an angle with the genæ, the antennæ villose, the outer tooth on each side of the head beneath abortive, and the anterior tibiæ nearly straight on their inner edge. The form of the tibiæ in *H. curvipes*, which is similar in both sexes, recalls that of the tibiæ in the male of *Pseudoblaps dispar*, Hbst. Those of *C. intermedius*, Geb., are apparently very similar, but this species, *inter alia*, has the mentum naked and a single frontal tubercle.

*Chirocharis (Hemipristis) kenyensis*, sp. n.

Black, shining; frons and clypeus moderately nitid and sparsely sculptured, the latter with two approximate, symmetrical, longitudinal carinæ; sides of head scarcely emarginate before eyes; frons with a pair of rather distant tubercles between the eyes; under side of head with two large teeth on each side between the mentum and the base of the mandible. Antennæ with first six joints glabrous, 7 to 10 sparsely setose, 11 opaque. Elytra ovate with striæ represented by lines of fine punctures, intervals flat. Anterior femora unarmed, tibiæ nearly straight on inner edge, outer face of intermediate tibiæ moderately strongly punctate.

♂ with round velvet-like spot on each side of second abdominal segment.

Length 33–35 mm.

*Hab.* British East Africa, S.E. slopes of Kenya; 6000–7000 ft.; Feb. 1911 (*S. A. Neave*).

In size and smoothness resembles *H. stygica*, Kolbe, but differs in the frons being nitid instead of dull, the clypeal carinæ approximate, the distance between them only about one-third of that between them and the angles of the clypeus, or of that separating the frontal tubercles. In *H. stygica* the distance between the clypeal carinæ is about equal to that between the frontal tubercles, or that between them and the angles of the clypeus. In the latter species, too, the pubescent spots of the second abdominal segment of the ♂ are replaced each by a smooth finely sculptured depression without pubescence.

Both these new species of large Passalid-like Tenebrionidæ enter into the genus *Hemipristis*, Kolbe, as originally defined (*Arch. f. Naturgesch.* 1903, Bd. i. Heft 2, pp. 165, 177) with the mentum densely hairy and the anterior femora unarmed. The genus was revised and a key to the species given by Gebien in his 'Revision der Pycnocerini, Lac.' (*Deutsch. Ent. Zeitschr.* 1904, pp. 120–122), but subsequently in adding a new species, *C. intermedius* (*Ergebn. der Deutsch. Zentr.-Afr. Exped.* 1907–1908, Bd. iv. Heft 5, 1912, p. 73), the same author united it with *Chirocharis*, Kolbe (type *australis*, Westw.), which was distinct only in having the mentum naked and the anterior tibiæ quadridigitate instead of tridigitate, the further character of the toothed anterior femora failing in *C. intermedius*.

Neither of the species now described can, however, be placed in the key given by Gebien, which requires modification to receive them as follows:—

- 1 (6). Clypeus with two parallel symmetrical carinæ; genæ beneath head (submentum of

- (Gebien) with two large teeth on each side; size smaller, 35 mm. or less.
- 2 (5). Frons and clypeus dull, clypeal carinae as far apart as the frontal tubercles; ♂ without tomentose patch on each side of 2nd abdominal segment.
- 3 (4). Elytra sulcate, intervals convex ..... *kraatzii*, Geb.
- 4 (3). Elytra striate punctate, intervals nearly flat. *stygica*, Kolbe.
- 5 (2). Frons and clypeus nitid, sparsely punctate; clypeal carinae approximate; ♂ with small roundish tomentose patch on each side of 2nd abdominal segment ..... *kenyensis*, sp. n.
- 6 (1). Clypeus with two tubercles near middle of anterior margin; ♂ with tomentose spots on each side of 2nd ventral segment; size larger, over 40 mm.
- 7 (8). Two large genal teeth on each side beneath head; frontal tubercles approximate, frontal intertubercular area rugose, longer than wide; anterior tibiae strongly bent and expanded internally beyond middle; ♂ with small subtriangular tomentose spots ..... *curripes*, sp. n.
- 8 (7). Only one, the inner, large genal tooth on each side; frontal tubercles about as far apart as clypeal tubercles, intertubercular area broadly transverse; anterior tibiae nearly straight on inner edge.
- 9 (10). Frontal area rugose, left clypeal tubercle larger than right; outer face of intermediate tibiae finely punctured; ♂ with narrow transverse tomentose spots ..... *mulleri*, Krtz.
- 10 (9). Frontal area smooth; clypeal tubercles subequal, divergent; outer face of intermediate tibiae coarsely punctured; ♂ with large round tomentose spots ..... *ukamia*, Kolbe.

In addition to the toment-spot on each side of the second abdominal segment of the male this sex, both in this and the allied genus *Chiroscelis*, is further adorned with a vertical comb of closely-set stiff rufous hairs along the inner face of the posterior tibia so placed as to be able to rub the toment-spot as the leg is moved up and down. Of this there is no trace in the female, and in those species in which the toment-spot is poorly developed or absent in the male this comb is much weaker, with more slender and fewer hairs, than in the species possessing a large toment-spot. The movements required are exactly those of a stridulatory apparatus, but the structure, stiff bristles rubbing over a patch of velvet, seems to place sound-production out of the question. A possibility remains that it may serve a scent-distributing purpose. Observations on the living insect on the functions of this two-fold apparatus are eagerly awaited.

LXXXVII.—On the Occurrence of the Genus *Epiceratodus* in the Upper Cretaceous of New South Wales. By ERROL IVOR WHITE, of the British Museum (Nat. Hist.).

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A SPECIMEN of an opalized Ceratodont tooth recently presented to the National Collection has proved to be of unusual interest in that it seems referable to *Epiceratodus*, and is therefore the earliest recorded specimen of the genus, which has otherwise been recorded fossil only from the Quaternary (E. I. White, 1925).

*Epiceratodus pattinsonæ*, sp. n.

*Specific characters.* Palatine teeth short and broad, stoutly built with inner (and posterior) margin rounded, closely apposed but not in actual contact mesially. Combs six in number, the last two being well-defined but less completely separated than the others; all radiate from a point in middle of inner margin, the first two curving backwards, the third being straight and last three curving forwards; size of combs diminishes from front to rear, free portions small. Combridges reach inner margin, valley separating first from second shorter than remainder.

*Holotype.* Left palatine tooth with bone attached, Brit. Mus., P. 13678.

*Form. and Loc.* Opal Beds (U. Cretaceous): White Cliffs, N.S.W.

*Description.* The tooth is complete except that the tips of the first two combs have been broken off. The shape of the tooth and the curvature of the combs are exceptional. The inner and posterior margins are confluent and form an almost perfect semi-circle, from the middle of which the combs radiate, the tips of the foremost curving gently backwards and those of the last three forwards. All the combridges reach the inner margin and the valleys separating them are equally extensive with the exception of the first, which is much shorter than the remainder.

The body of the tooth is broad, the breadth measured along the second valley being but little shorter than one-half the length preserved, i. e. the length without free portion of the first comb. The free portions of the perfect combs are stumpy, and that of the second was probably similar, but the first, the ridge of which is quite narrow, was most likely to have been longer. No denticulations are to be seen on the outer edges.

The openings of the dentinal tubuli are preserved in the opal so that the worn tritoral surface is pitted.

Much of the palato-pterygoid bone is preserved and its general form indicated, though the exact outlines are a little uncertain. Along the symphysis there is a small margin of bone at the base of the tooth, which shows that the teeth were not in actual contact, although placed closely together. Behind the symphysis, the deflection of the margin is so

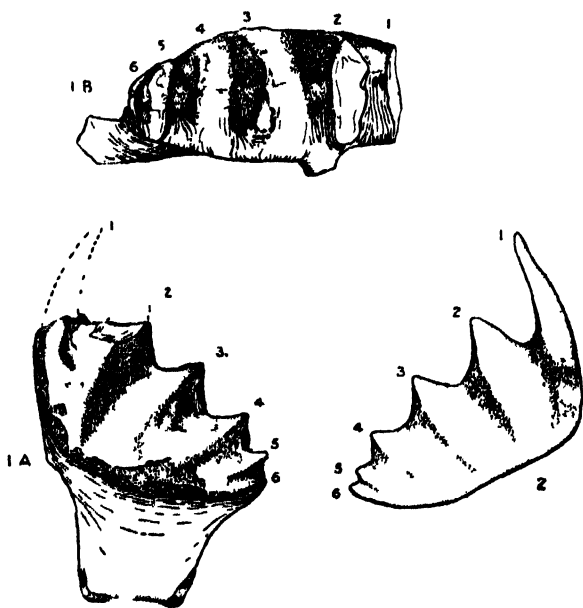


Fig. 1.—*Epiceratodus pattinsonae*, sp. n.

Left palatine tooth with bone attached. A, oral, B, external view (inverted). [P. 13678—slightly enlarged]

Fig. 2.—*E. pattinsonae*, sp. n.

Reconstruction of left splenial tooth. [1-6, comb-ridges.]

slight that the anterior part of the parasphenoid must have been extremely narrow, especially as the steepness of the thick edge precludes any possibility of overlap. The bone behind the tooth is very broad and the hinder part of the inner margin of the tooth lies roughly at right-angles to it.

The aboral surface of the bone is flat and featureless, except for the stump of the ascending process which lies immediately above the second comb.

*Comparison with other species.*—The teeth of four other authentic species of Ceratodonts are known from Cretaceous rocks, and all these are referred to *Ceratodus* itself. Three of them come from Africa, and of these, *C. africanus*, E. Haug (1905), has flat triangular teeth, *C. minutus*, E. Haug (1905), is based on a small splenial tooth with four combs, and *C. humei*, F. Priem (1914), has large dental plates of which the upper are flat with five short, almost parallel combs and a strong inner angle.

The fourth species, *C. (Metaceratodus) wollastoni*, F. Chapman (1914), requires more careful consideration, as it comes from the same beds as the new tooth and from a locality, Walgett, only 350 miles from White Cliffs. Moreover, as it is a splenial tooth, there is the possibility that the new specimen may be the upper tooth of the same species.

The teeth of Ceratodonts fit closely together and it is possible to reconstruct the lower plate from the upper. The inner margin cannot be fixed with certainty, as the lower tooth is usually the narrower and the inner margin varies accordingly.

If the reconstruction (fig. 2) is compared with the splenial tooth of *C. wollastoni*, it is obvious that the two differ in many respects. Firstly, there is the discrepancy in the number of combs; in *C. wollastoni* only three are preserved and it is probable that only four were ever present, but as the last two are generally very close together, there may have been a fifth, although this is not likely; while as splenial teeth sometimes have one comb fewer than the palatine teeth, the reconstruction may have one too many: hence it is just possible that both forms had five combs. Secondly, in Chapman's species the tritoral surface is smooth and the comb-ridges do not reach the inner angle. This might be accounted for by the unworn condition of the tooth\*, which, however, is rather too large, and the exposure of the dentinal tubuli suggests that such is not the case. Moreover, the direction of the straight combs differs from what one would expect in the lower teeth of *E. pattinsonæ*, especially in the hinder part, and the first comb is prominent and continuous and could not work in the shortened valley between combs 1 and 2 of the new tooth.

\* In the description of *E. eyrensis* (mihi, 1925, p. 141, pl. vi. fig. 6) it is stated that a small tooth is "very worn, the ridges on the grinding-surface being totally obliterated." This is incorrect, for although one generally associates smoothness with wear, it is quite apparent that the movement of the combs one against another will deepen the valleys and so strengthen the combs: hence smoothness in this case is actually a sign of an unworn condition!

It is certain, therefore, that the two forms are distinct.

*Systematic Position.*—The question as to which of the genera *Ceratodus* or *Epiceratodus* an isolated tooth such as this should be referred is not easy to decide, since these genera were separated on differences in the skull. Stromer and Peyer (1917, p. 76), however, have suggested a number of characters as being distinctive of *Epiceratodus*, and these are:—

- (a) Vomerine tooth present.
- (b) Teeth somewhat variable.
- (c) Teeth 2–3 times as long as broad, the grinding-surface being  $\frac{1}{2}$ – $\frac{3}{4}$  of the total breadth.
- (d) General absence of inner angle except occasionally behind.
- (e) 6–7 combs in upper, 6 in lower teeth.
- (f) Slight symphysial contact of upper, and wide separation of lower teeth.

These observations were based on the then only known species, the living *E. forsteri* (Krefft). Since then two other species from the Pleistocene have been described (E. I. White, 1925) which render necessary some modifications in the above list.

The question of the absence of the vomerine teeth in *Ceratodus* is open to doubt, and I am still inclined to think that it may be fortuitous, in spite of what Peyer (1925, p. 16) says on this subject.

Variability is certainly not peculiar to one genus or the other to judge by the specimens of *C. africanus*, Haug, described by Peyer (1925).

In *E. eyrensis*, White, the total breadth measured across the first comb is at least  $\frac{2}{3}$  of the length and there is a prominent anterior inner angle, so that (c) and (d) cannot be regarded as constant characters of the teeth of this genus.

The number of combs is a helpful indication, for, as Stromer and Peyer point out, in the palatal teeth of *Ceratodus* it is usually, in the lower teeth always, less than six. But this is not helpful in determining a palatal that has six combs, although it is suggestive of *Epiceratodus* rather than *Ceratodus*.

The symphysial contact of the upper and lower teeth is, however, more relevant. Actually, in five out of six upper dentitions of *E. forsteri* in the British Museum there is no actual contact at all between the teeth, and in the sixth they are separated at the base. On re-examination of the types of *E. eyrensis* and *E. gregoryi*, the same conditions appear to have been present, so that the statement in the diagnoses of

these species that the upper teeth are "in close contact mesially" is misleading.

It is evident, therefore, that the only constant difference between the teeth of the two genera is in the degree of separation of the teeth. In *Epiceratodus* neither upper nor lower teeth are in contact and the latter are the more widely separated.

It is on this evidence of the separation of the palatal teeth of the new species that it is referred to *Epiceratodus*, and this is further supported by the number of combs—six.

It may be mentioned in passing that Chapman (*loc. cit.*) created a subgenus *Metaceratodus* for the Australian Jurassic and Cretaceous species, *C. avus* and *C. wollastoni*, owing to the presence of characters supposedly intermediate between the two genera in question. The paucity of combs is indeed characteristic of the older genus, but it is difficult to see where its affinities with the living fish lie—the presence of a scale similar to those of *E. forsteri* in the same beds as *C. avus* can hardly be held to be a good reason for erecting a new subgenus for both the Mesozoic forms, and the pitting on the surface of *C. wollastoni*, which is also mentioned, is common to all the Ceratodont teeth that I have examined from the Trias upwards: it is purely structural and due to the exposure of the dentinal tubuli by the wearing of the surface. The subgenus *Metaceratodus* is therefore not well founded, and it does not seem possible, in view of the variability in the characters of the teeth of the various Mesozoic species, to define satisfactorily a subgenus (or genus) intermediate in dental characters between *Ceratodus* and *Epiceratodus* (= *Neoceratodus* auct.), nor is such a subgenus necessary.

*Affinities.*—The affinities of such an isolated specimen cannot possibly be determined with any certainty, but of the teeth of the three Mesozoic species from Australia this tooth certainly resembles those of the living and Pleistocene fishes most closely, and it is not improbable that the fish to which it belonged was truly an ancestral form of the Quaternary species.

The specimen described above was not found *in situ*. It came into the possession of Mrs. T. Pattinson, who, through the interest of Mr. C. Davies Sherborn, has generously presented it to the National Collection. The species is named in her honour.

#### LITERATURE.

- AMEGHINO, F. 1906. Ann. Mus. Nac. Buenos Aires, xv. p. 71.  
CHAPMAN, F. 1914. Proc. Roy. Soc. Victoria, n. s., xxvii. p. 25.



- HAUG, E. 1905. In Foureau, Docum. Sci. Miss. Saharienne, ii. p. 819.  
 PEYER, B. 1925. Abh. Bayer. Akad. Wiss., Math.-naturw. Abt., xxx. Abh. 5.  
 PRIEM, F. 1914. Bull. Soc. Géol. France, (4) xiv. p. 368.  
 STROMER, E., and PEYER, B. 1917. Zeitschr. Deutsch. Geol. Gesell. lxi. p. 78.  
 WHITE, E. I. 1925. Ann. & Mag. N. H. (9) xvi. p. 139.  
 WOODWARD, A. S. 1906. Ann. & Mag. N. H. (7) xviii. p. 1.

## PROCEEDINGS OF LEARNED SOCIETIES.

### GEOLOGICAL SOCIETY.

March 10th, 1926.—Dr. F. A. Bather, M.A., F.R.S.,  
 President, in the Chair.

In exhibiting plaster casts of parts of the skull of the type-specimen of *Deuterosaurus biarmicus* Eichwald, a primitive reptile from the Permian of Russia, FRANZ, Baron NOPOSA, For. Corresp. G.S., said that *Deuterosaurus* proves to be intermediate between the mainly North American Pelycosaurians and the South African Dinocephalia. The copper-bearing strata in which Deuterosaurs are found contain also typical Deinocephalians, but are evidently somewhat lower than the *Tapinocephalus* Beds of South Africa. They are followed upwards by the reptiliferous beds of the Dwina that contain the same Reptiles as the lower and middle beds of the Beaufort Series in South Africa, and these are again followed, in the Governments of Kostroma and Vologda, by beds containing Thecodontia. Thus the succession of the vertebrate faunas of Russia is the same as in South Africa; but it seems as if the South African fauna originated in the North, as, besides *Deuterosaurus*, the higher Dwina Beds have also yielded remains of a primitive forerunner of the Cynognathia that is hitherto unknown in South Africa.

The following communication was read:—

‘Cretaceous Glaciation in Central Australia’. By Walter G. Woolnough, D.Sc., F.G.S., and Prof. Sir T. W. Edgeworth David, K.B.E., C.M.G., D.S.O., D.Sc., F.R.S.

Evidences of glacial action in Central Australia were recorded more than forty years ago by the former Government Geologist of South Australia, H. Y. L. Brown. The evidence is mostly in the form of numerous erratics and occasional beds of tillite. Later Sir Baldwin Spencer, Dr. J. A. Watt, and the late Prof. Ralph Tate described the occurrence of undoubted glacial deposits in the heart of Australia at Yellow Cliff and Crown Point. Originally all these occurrences were referred to one and the same glaciation, assumed to be of Cretaceous-Tertiary or possibly Jurassic age.

As the result of later researches by L. K. Ward and R. L. Jack, of the Geological Survey of South Australia, Prof. W. Howchin, Dr. H. Basedow, and the Authors of this paper, it was demonstrated that the occurrences belonged to two distinct geological horizons, the older almost certainly Permo-Carboniferous, and the newer probably Jurassic to Cretaceo-Tertiary. Recently, one of the Authors (W. G. W.), when exploring the salt-lakes of Central Australia on behalf of Brunner, Mond & Co., was fortunate enough to discover good evidence as to the age of the later glaciation. Recent observations by Ward and Jack have shown that the erratics are distributed in vast numbers over an area of South Australia measuring about 200 by 100 miles. They vary in size from a foot or so up to 5 feet in diameter.

The most recent expedition (by W. G. W.) has led to the discovery by him of marine fossils in the same matrix as that in which the erratics are embedded. They consist of stems and calyx-plates referable to one of the Pentacrinidæ, and imperfectly preserved valves of pelecypods, mostly *Aucellina*. The erratic-bearing sandy mudstones show a considerable transgression across the marine Lower Cretaceous rocks containing very large specimens of *Orioceras*, and referred by F. W. Whitehouse to the Aptian horizon. The erratic-bearing beds, together with a thick series of freshwater strata with lignites, which mostly overlie the glacial deposits, are termed the Winton Series. They are followed by strata making locally a distinctly unconformable junction with them and probably of early Tertiary age. These latter beds belong to the Eyrian Series, which in places carries fossil leaves of *Eucalyptus*. The occurrence of *Aucellina* and forms allied to *Isocrinus* in the Winton Beds at Moolawatina (south-west of Lake Callabonna, north-east of the northern end of the Flinders Range of South Australia), added to the above data, suggests contemporaneous glacial action in Middle Cretaceous time. F. W. Whitehouse opines that the age may approximate to Albian. If so, it would accord with the New Zealand evidence of a great orogenic movement in those islands soon after the close of Neocomian time. This revolution was accompanied by widespread intrusions of dunite and other igneous rocks in New Zealand.

The Authors suggest that the crust-movements, which were orogenic in New Zealand, expressed themselves as epeirogenic uplifts in Australia, and account for the fact that the Cretaceous Mediterranean of Australia gave place soon after the close of Aptian time to a vast freshwater lake: for marine sedimentation, although in places represented by small patches of Albian, mostly ceased even before Albian time. In some localities, especially perhaps in the Gawler Ranges, the land rose so high, as the result of the uplift, that it harboured glaciers of no little extent. Bergs derived from the latter rafted erratics into the Winton Lake, as well as into some of the adjacent, intermittently marine, estuaries, probably in Middle Cretaceous time.

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END OF THE SEVENTEENTH VOLUME



2



6



4



8



7



10



9



12.



11

H G Herring, photo

1, 2, PYRGOMA. 3-11, CREUSIA. 12, CALANTICA (TITANOLEPAS)







7



1 nat size



3

x 4



4

x 4



6

x 16



5

x 4

A



2

x 4

Dollman phot

R B Newton, direx





6 *x 4*



7  
*x 4*



3 *nat size*



1 *nat size*



5 *nat size*



2 *nat size*

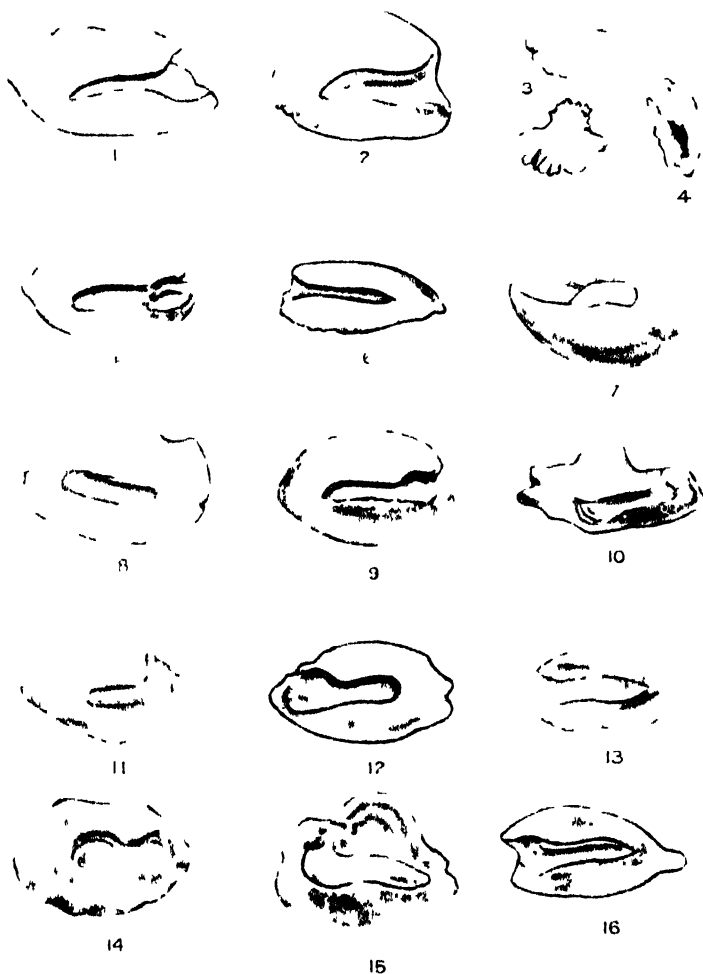


4 *nat size*

P Dollman phot

R B Newton, direx





G. Allen Frost del.

OTOLITHS OF THE ORDER APODES



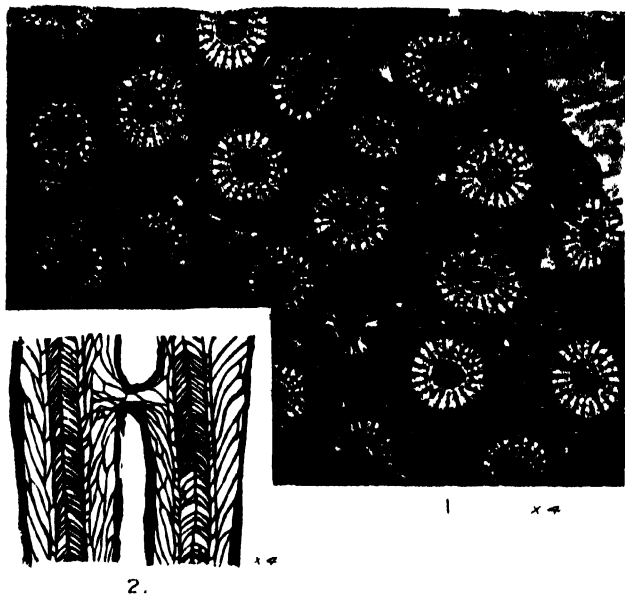


J W. Tutcher, photo

**CORWENIA RUGOSA (MC COY.) & CORWENIA VAGA sp. nov.**  
 (All figures, except 1 & 3b, are magnified 1.5 diameters)



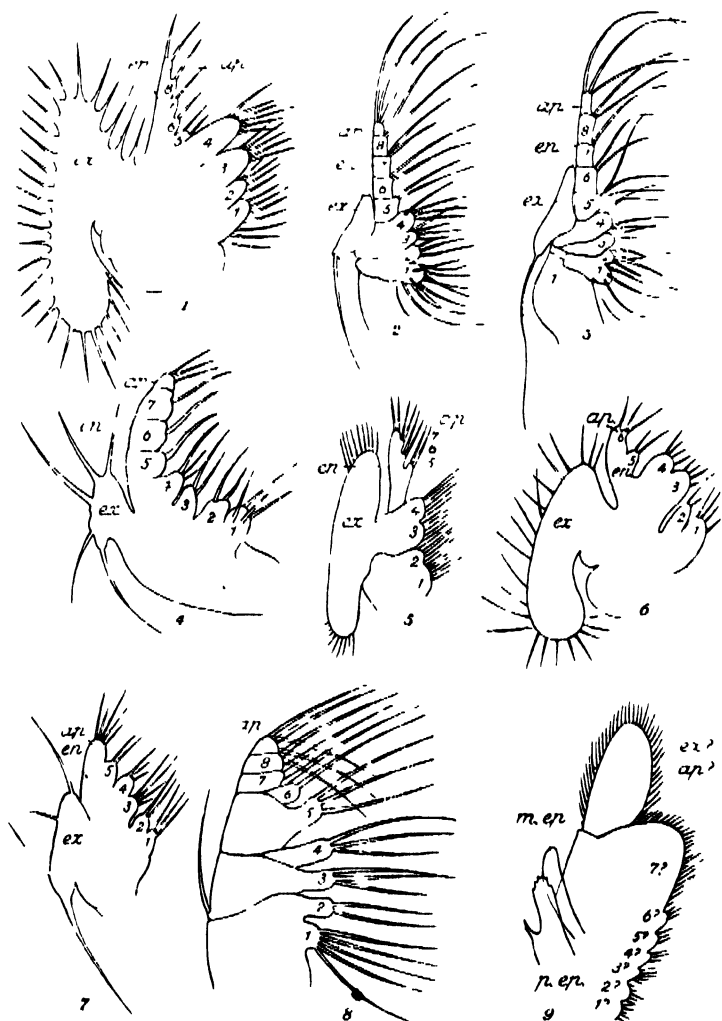




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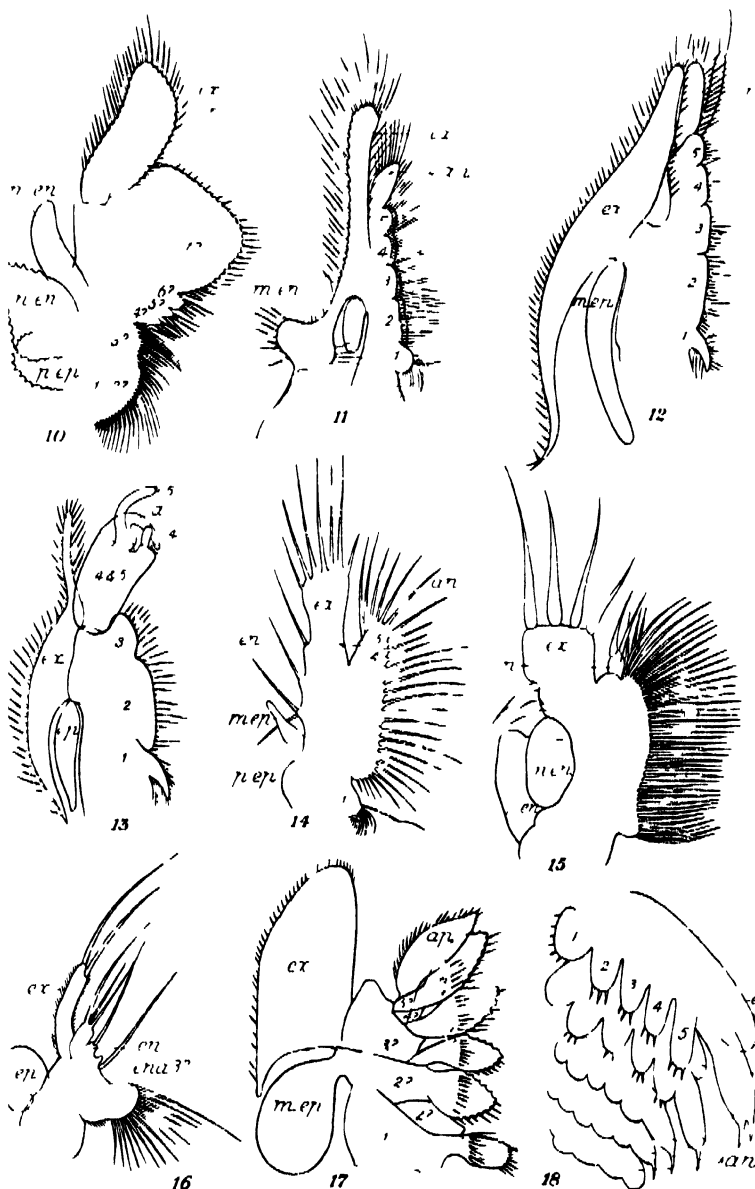
A CORAL, gen. et sp. nov., IN THE BRITISH MUSEUM (R.22380).





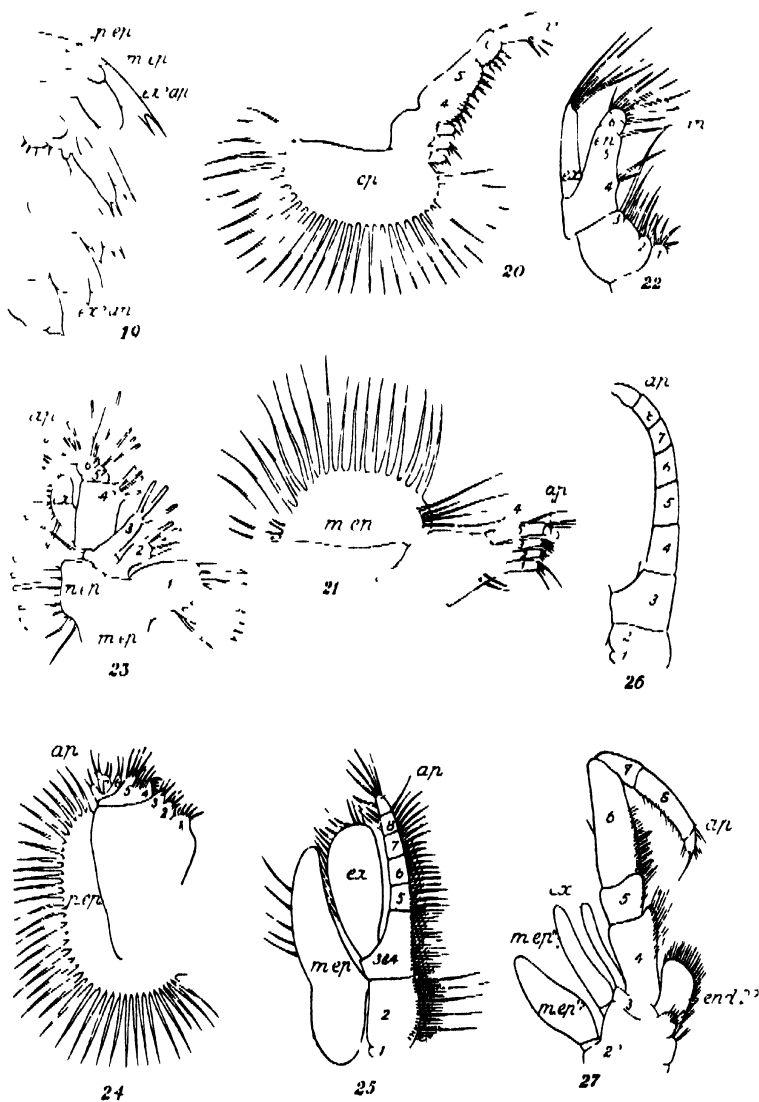
Crustacean Limbs.





Crustacean Limbs

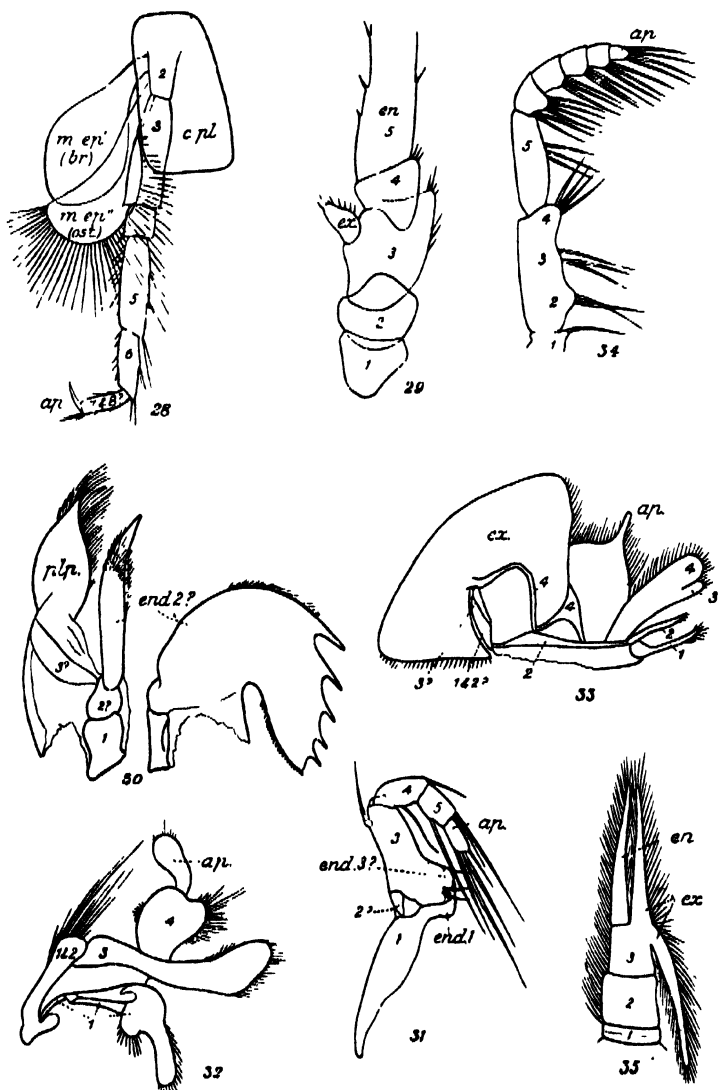




Crustacean Limbs.

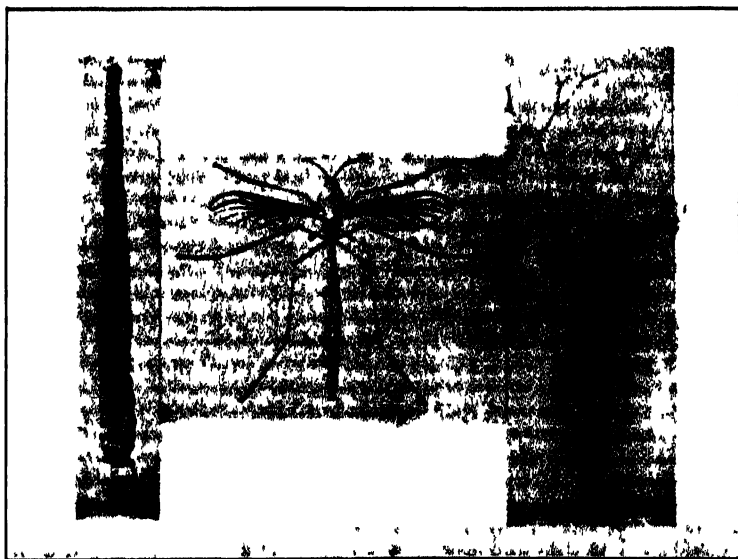






Crustacean Limbs.





**Boletophila (Arachnocampa) luminosa.**





G M Woodward del

**MEGALOMYS AUDREYÆ, sp n.**

1. Left ramus mandibulæ,  $\times 5$ .      2. Upper incisor,  $\times 5$ .



1 x 5



2 x 20



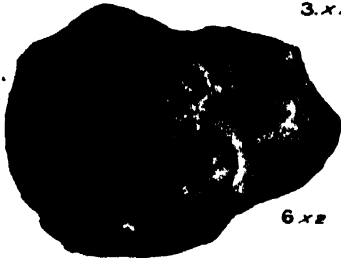
3. x 20



4. x 20



5. x 10



6 x 2

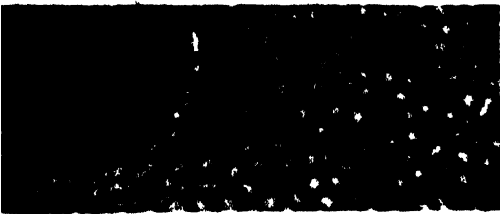


7 x 10



8. x 20

9. x 10



10. x 10



Micro-photo by W L F.N.

LEPIDOCYCLINA.





FORSTER COOPER

*Ann. & Mag. Nat. Hist. S. 9. Vol. XVII. Pl. XIV*



1



2



3



4

HEMPSTEAD BED ANTHRACOTHERES





1.



2.



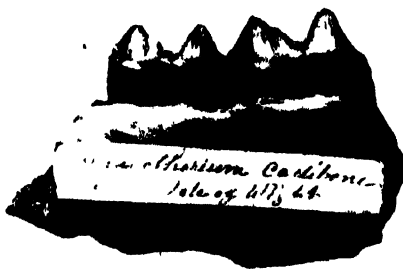
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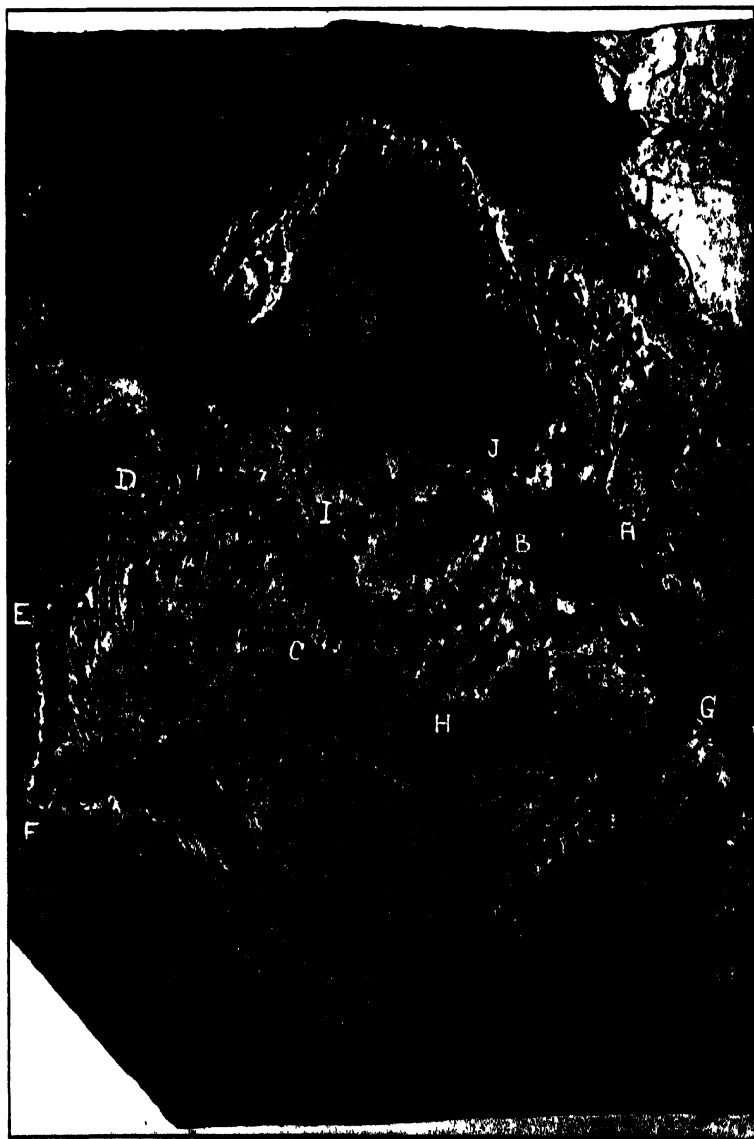


6.



7.





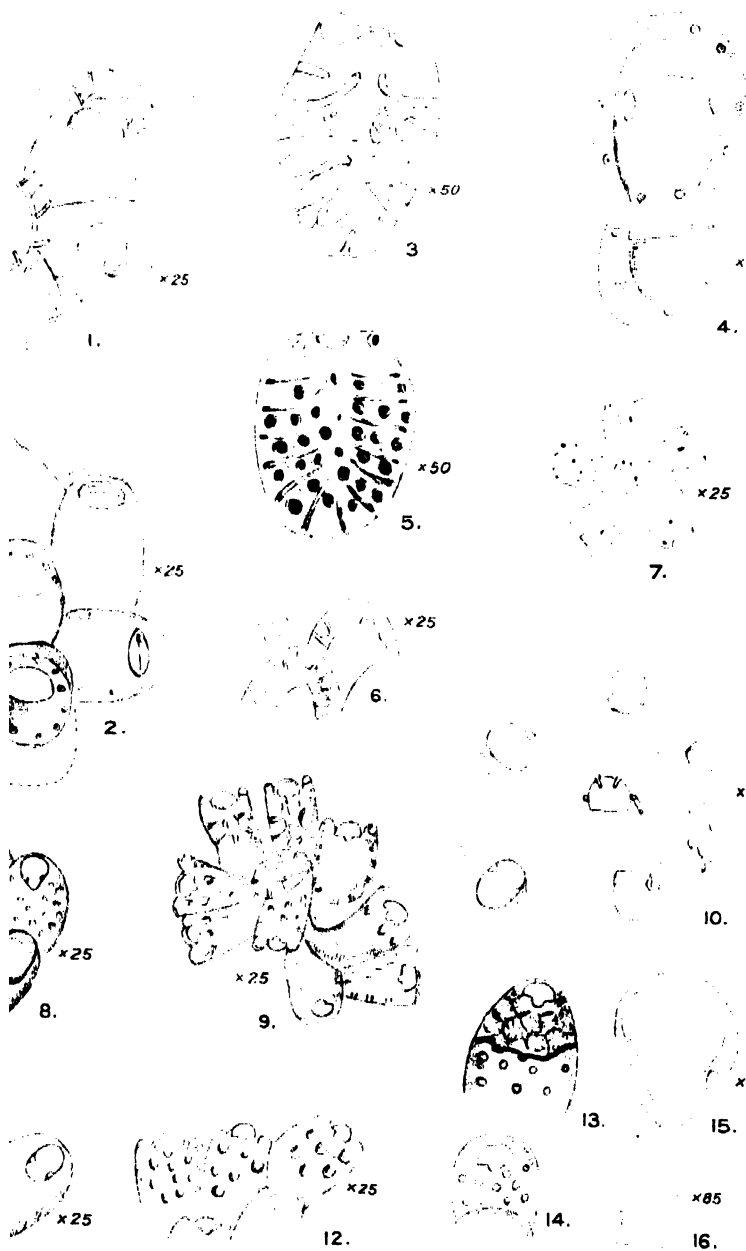
*Daunophis langi*, gen. et sp. n.



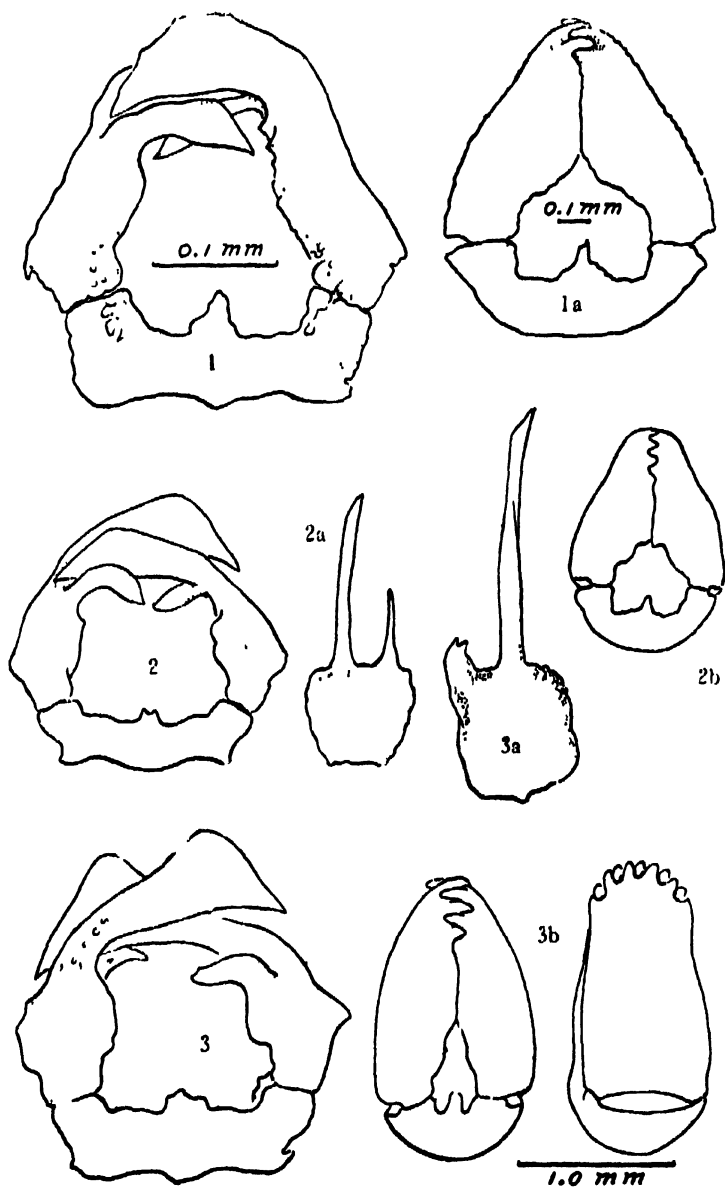










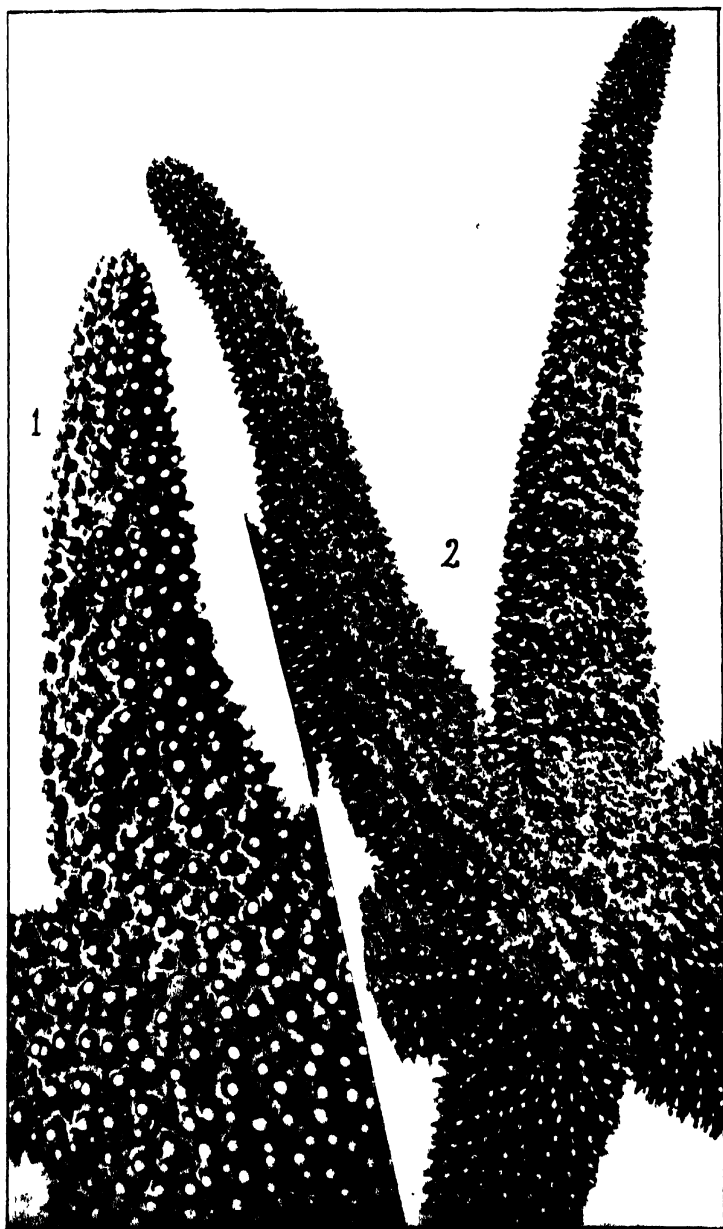
**Pisaster, a Genus of Sea-Stars.**





**Pisaster, a Genus of Sea-Stars.**





**Pisaster, a Genus of Sea-Stars.**







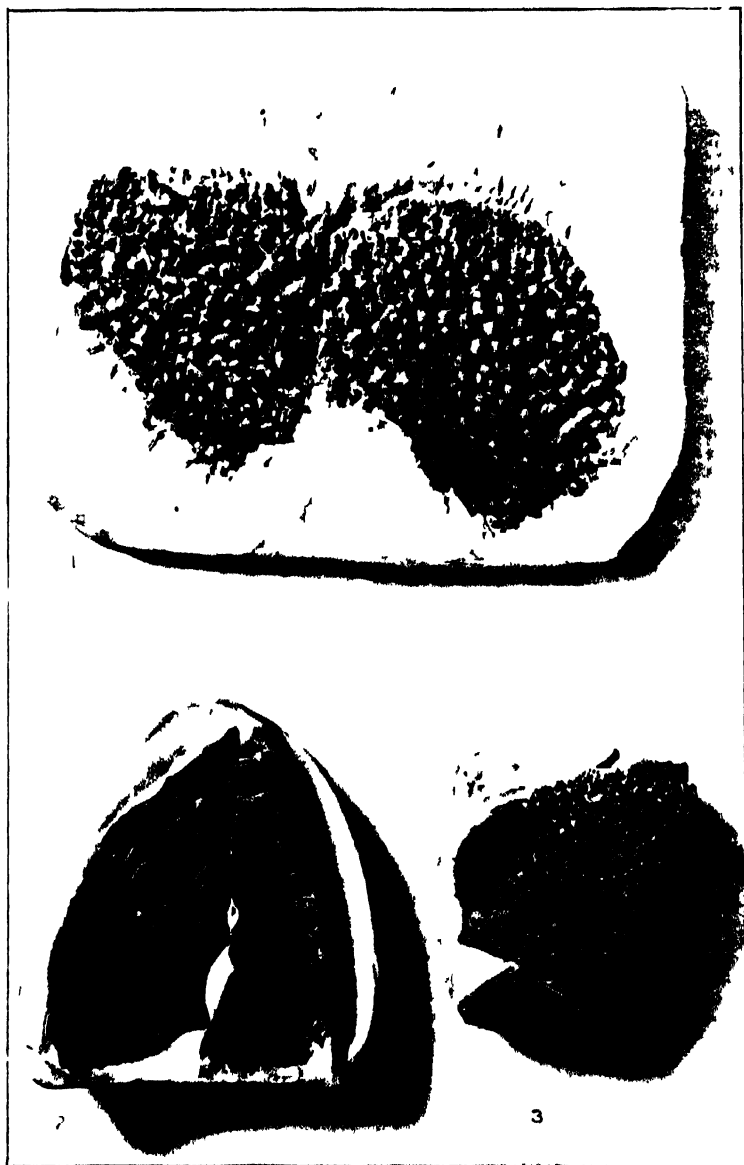
**Pisaster, a Genus of Sea-Stars.**





**Pisaster, a Genus of Sea-Stars.**





H. G. Herring, photo

*Aptychus spinosus*, sp. n. Upper Chalk.



